THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1909 EDITION

H. ALABASTER, GATEHOUSE & CO.,

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THE NEED OF CO-OPERATION IN THE ELECTRICAL INDUSTRY.

SUCH is the title of a pamphlet issued by a Provisional Committee formed some time ago with a view to formulate a plan for the foundation of an Electrical League having for its object the removal of the depression from which the industry is stated to be suffering.

The pamphlet may, we presume, be considered to be the manifesto of the League. Before offering our own remarks, we will give a *précis* of the ground covered and the arguments presented in its pages.

It is stated that the condition of the industry, as a whole, is in many respects unsatisfactory, notwithstanding the strides which have been made on the scientific side, and the enormous developments which have taken place. Manufacturing and contracting profits are inadequate, restrictive conditions are complained of both by municipalities and companies, shareholders are disappointed about their dividends, and consulting engineers lack work from the lack of capital to expend.

The primary cause of our misfortunes is stated to be premature and ill-advised legislation, while the apathy of the Legislature in regard to representations which have been made is regarded as the chief obstacle to reform. The adverse legislative conditions here are contrasted with the assistance rendered to manufacturers and contractors in foreign countries by their Governments.

The reason why our Legislature does not deal sympathetically with the situation, is that those interested in the industry fail to secure Parliamentary attention—they lack cohesion, and are unable to make themselves heard. "Excessive competition and mutual distrust" is the marginal summary of a quotation from a financial contemporary dwelling on those features as applied to electrical firms. Lord Harris had expressed his profound conviction in the honesty of Parliament as long as it thoroughly understands what it is legislating about, but people were too busy to read lengthy Blue Books, and, therefore, many members of Parliament did not understand the difficulties that surround the very delicate telephone service, and this view the Committee think also applies to legislation in regard to other departments of electricity. The industry especially requires and deserves to be fostered, it is peculiarly susceptible to legislative and departmental control; it is exposed to many dangers and attacks from outside, yet is unable to raise its voice in its own defence. The Institution represents the industry on its scientific side, and other societies represent various branches, but facilities are required for the elimination or adjustment of sectional differences and for joint action. What is needed is an organisation which will impress the general public and Parliament with the vast commercial interests represented by the industry, will support the representations of existing societies by bringing the

public voice to bear thereon, and enable deputations to Government departments to speak out, not merely with the authority of experts, but also with the force and weight of numbers. The Institution cannot be expected to do the work necessary to secure Parliamentary and public recognition of the important scientific conclusions it promulgates, though six years ago it appointed a committee which passed a series of resolutions to the effect that electrical enterprise had not attained that stage of industrial development which might have been expected. A deputation to the President of the Board of Trade followed, and it obtained promises which have not matured. Public pressure is needed to help the Government departments. There are sectional differences, particularly between municipalities and companies, but these sectional difficulties are not so great that they cannot be subordinated to the general interests. There never has been sufficient solidarity in the electrical industry, and consequently whenever the opportunity for legislation has arisen, the interests have not been sufficiently united nor emphatic enough in their demands. The industry, so far, has not influenced Parliament, and the formation of the Electrical League is suggested, in order that its collective action may obtain for it the necessary recognition and attention.

It is proposed that the invitation to join the League should be extended to everyone who is in any way interested in electricity, whether as shareholder, consulting engineer, town councillor, manufacturer, contractor, or trader—whether employer or employé, at a minimum subscription of 2s. 6d. per annum, or a commutated payment of £1. The desire to advance the general electrical interests of the country will be the basis of the League; in its collective capacity it will start with neutrality on all contentious matters; its ultimate object will be to endeavour to reconcile conflicting views and to assist development in any manner found advisable after a careful consideration of the causes which hamper industry and diminish prosperity.

In conclusion, it is recognised that the formation of the League cannot be expected to immediately produce the desired improvements, but the longer the work is delayed the more serious will the disorder become. Moreover, in view of the probability that fiscal, social, and industrial questions will occupy a prominent place in the practical politics of the near future, it is eminently desirable that the electrical industry should be represented by an organisation able to enforce a consideration of its claims.

In the above summary we have given the main portions of the manifesto of the League, and as far as possible in the actual words used in the pamphlet. That some proposal of the kind was to be put before the electrical world we have for some time past been advised.

We have to consider whether this is the well thought-out scheme we have been led to expect. We fear that it must, on the contrary, be regarded as merely a plausible statement in moderate language, of immoderate aims [impossible of attainment. Is there any industry which has an organisation representing the combined interests of masters and men, buyers and sellers, socialistic and individualistic enterprises? We do not adopt the statement that the industry is still in its infancy, but we do regard it as comparatively young and as having a brilliant future. Its youth, energy and inventive capacity may refuse to accept the principle that its limitations are those of older industries. "In the lexicon of youth . . . . there's no such word as 'fail,'" but a League which is to accomplish a reversal of the ordinary governing principles of human nature is wise to recognise that the desired improvements cannot be immediately expected.

It is not quite clear to us as to what is expected from legislation. The resolutions of the Institution to which reference is made defined the nature of the amendments required. It related in the main to the power of veto on the part of local authorities to prevent or delay the carrying out of electric projects, the utility of which could be shown. A definite proposal for a desirable change was influentially supported, and it has not yet come about. Changes seldom do come about readily in Parliament, more especially, in the recent past, those which touch upon the rights of municipal bodies. The ignorance of Parliament, the dilatoriness of Parliament, will not be called in question, but so far as the case quoted in the manifesto is concerned, we must point out that the view expressed does not equally apply to other branches of electrical industry. Parliament had to deal with the question of the telephone because it is a Government monopoly. No other than the message transmission branch of the electrical industry occupies that position. The mistakes of Parliament are proverbial, and every reasonable means of education should be utilised, but defective as our Parliamentary system is, it will be generally recognised as superior to most others. And though we by no means underrate the beneficial influence of representative bodies, we think there is reason to fear that an organisation of such incongruous elements as the proposed League would find too few subjects upon which all were united to render its operations in this direction of any practical educative value.

There is much in the pamphlet upon which all will be agreed. It is perfectly true that in many branches of work shareholders have good reason to be dissatisfied with the returns on their capital, and that in many other branches hard times have been experienced, but the electrical industry as a whole is not in the parlous condition the manifesto might be considered to suggest. Nevertheless, the recital of depressing influences will doubtless find responsive echo in many quarters, and the hope of amelioration to be obtained by membership of an inexpensive Association should account for many members, but we believe that shareholders, as a rule, are well aware that no new legislation is required to permit the payment of dividends which have been earned, and that there is no probability of any legislation which will materially assist in earning them. To remove the causes of jealousies within sections of the industry and between sections of the industry may be a very desirable thing, but it is difficult to see how any section is to be influenced by an organisation which is so constituted as the proposed League. The pamphlet says that there are numerous sectional societies doing good work, but joint action is required, and such joint action it is proposed to secure not by a system of delegation or representation of such separate sectional societies, but by an organisation in whose membership a section or sections may have no representation at all.

If the proposed League offers little opportunity for good, does it offer opportunity for harm? We fear that it does.

Perhaps the greatest harm is of an indirect and intangible nature. Its recital of legislative shortcomings and its hopes of legislative remedies will enable many a reckless trader to persuade himself that he is the victim of others' machinations rather than his own worst enemy, and the expectation that the League will bring him better times will induce him to hold on to false hopes instead of early realising where the faults lay. And if but little good can be hoped from representation, much harm may arise from misrepresentation. A league or association deriving weight from collective membership, not infrequently is run for the benefit of a very small section, and this though its foundation were considered to be of the fairest and soundest character. In the present case there is no occasion to doubt the good intentions of the formative committee, yet it is not difficult to see possibilities of the drawback to which we have referred. The proposed subscription is a minimum of 2s. 6d., without any limit as to maximum. A large membership may be obtained without a large fund accruing for the legislative and other propaganda. In the absence of a maximum subscription, members or sections will be at liberty to contribute such funds as they please, and whatever agitation may be embarked upon, may be expected to have a bearing on the interests of the contributing parties. Such a feature may well be entirely contrary to the ideas of the promoters now, but its possibilities must not be overlooked, especially in connection with the final paragraph of the manifesto.

The Lowest Tender.

The following passage appeared in the *Daily Telegraph* of January 2nd :—

The Home Secretary has refused to sanction the contract with Messrs. Waring & White for the superstructure of the new county lunatic asylum at Colchester, for the reason that the contract was not the lowest; that other firms were not afforded the same opportunity of reconsidering their tender as was afforded to Messrs. Waring & White; and that the acceptance of this firm's tender involves a system of sub-contracting which, in Mr. Gladstone's opinion, is in itself open to serious objection.

It appears that the Visiting Committee of the asylum in inviting tenders had made it clear that they would not bind themselves to accept the lowest or any tender; and that relying upon getting the contract, Messrs. Waring incurred liabilities amounting to £3,000.

We have no knowledge of the facts or merits of the case. Indeed, the sum total of our information is comprised in the above few lines. The decision of the Home Secretary, however, is of interest from many points of view. It shows that the Government will intervene to prevent what it considers to be an improvident contract on the part of a local authority; and that inquiry will be made in order to ascertain whether there are sufficient grounds for rejecting the lowest tender. The fact that the Home Secretary has intervened in a matter coming within his province may lead the President of the Local Government Board to do likewise in relation to some of the numerous contracts which come before him.

While we do not wish to urge that local authorities should always be compelled to accept the lowest tender, it is necessary in the interests both of the public and of contractors that every case in which a high tender is accepted should be closely scrutinised. A case which came before the Court of Appeal at the close of 1907 has demonstrated the fact that a Local Government Board auditor has little or no power in this respect.

In the case in question a district auditor, acting under Sec. 247 of the Public Health Act, 1875, made certain surcharges against the Highways Committee of the Westminster City Council in respect of a contract for the supply of goods, upon the ground that the tender for the supply of the goods which was accepted was not the lowest tender, and against the engineer in respect of alleged negligence in checking deliveries of shingle, and he disallowed the amount which he estimated as the loss to the ratepayers therefrom. The Highways Committee stated that they had accepted the tender which they considered the most advantageous. It was held that, with regard to the contract for the supply of goods, the Highways Committee had acted honestly in the matter, and there was no evidence of negligence; and that, with regard to the shingle, even if there was any evidence of short delivery, as to which the Court was not satisfied that there was any such evidence, there was no evidence of negligence on the part of the engineer, and that, therefore, the tender was good, and the surcharge unjustifiable. The following passage from the judgment of the Master of the Rolls illustrates the principle on which the Court will act: "The auditor asked the Committee why they had recommended the acceptance of these tenders. The Committee declined to give their reasons, and the auditor thereupon surcharged them with the amount by which he held the Corporation had been the loser by reason of the non-acceptance of the lowest tenders. In my opinion there is no justification for this charge. The members of the Committee were admittedly honest in their recommendation, and to find them guilty of negligence because they declined to explain their reasons is equivalent to saying that in this particular jurisdiction guilt is to be presumed until innocence is proved. In my opinion there is no evidence to justify the finding of negligence." It would appear from this case that it would require something in the nature of actual fraud to justify a Local Government auditor in setting aside a tender.

Watching the Scrap.

The Philadelphia Rapid Transit Co. finds that a good deal of money is to be saved by keeping an eye on the old material for which new stock is issued, and regulations are in force requiring the return of such things as brass journals, check plates, car trimmings, and even less strictly, bolts and carbon brushes, before new ones are issued.

Instead of being thrown on to the scrap-heap and sold for a fraction of their cost, old bolts are re-threaded or cut down to different sizes for stock, and other worn parts are brought in as far as possible for other sizes. About 25 per cent. longer life is got out of the more expensive carbon brushes by cutting them down for use in smaller motors. Just the same sort of thing is being done in many tramway depôts in England, but there is room for more care in others. A careless foreman could waste the equivalent of his wages on the scrap-heap during the year, and probably a great deal more where there is a large number of cars, so that an occasional—more than casual—glance at the scrap heap will repay the rolling stock superintendent.

American Permanent Way.—A glance at a paper read before the first annual meeting of the Arkansas Association of Public Utility Operators does not disclose any novel feature, but we are glad to note that a well-paved surface is recommended as not only the most suitable for other traffic, but the most economical for the company as well. Shortly, the specification of the permanent-way recommended by the author is as follows:—

Sub-grade.—At least 10-in. ballast, formed at the bottom of rough rock for drainage, and at the top of finer stuff for bedding the sleepers.

Sleepers to be used in preference to the concrete stringer or longitudinal beam which has been so largely adopted in the States. The sleepers to be treated and placed 21 in. centre to centre.

Rails.—Standard T section 60 to 90 lb. per yd., according to traffic and weight and speed of cars.

Bonds.—Protected type. Hole in web of rail and bond-head to be tinned.

Joints.—Sole-plates under rail-joints.

Concrete.—After the "sub-grade" and track are completed, the entire surface of the prepared road-bed should be covered with a layer of cement concrete. Proportions: 1 of cement, 3 of sand, 5 of crushed stone, laid to a depth of 6 in.

Paving.—Brick or stone blocks laid upon a cushion of sand from 1½ in. deep in the centre of the track to ¾ in. to 1 in. deep at the rails.

A SPANISH POWER TRANSMISSION PLANT AT 66,000 VOLTS.

[BY OUR BERLIN CORRESPONDENT.]

While the electric pressures used by European plants for the transmission of electrical energy have been until quite recently comparatively moderate, the plants installed between Kykkelsrud and Hafslund, in Norway, and between Moosburg and Munich, Bavaria, for the first time utilised a pressure of 50,000 volts. The power transmission plant recently completed by the Oerlikon Co. between Gaucin and Seville next held the record of European plants, both for the length and the pressure of transmission (52,000 volts), but the plant, at present under construction, of the Sociedad Hidroeléctrica Espanola, which is destined to transmit as much as 30,000 H.P., is designed for a pressure of no less than 66,000 volts.

The distance of power transmission also will beat all former records so far as Europe is concerned. While the two lines first mentioned are 42 and 54 km. in length respectively, the two branch lines from the Molinar power house to Valencia and Alcoy are each 80 km., that leading to Cartagena is 160 km., and the line leading to Madrid 240 km. in length (see fig. 1). In fact, the conductors constituting this high-pressure power transmission traverse about one half of the Iberian Peninsula. The copper weight of the Madrid line, which is to consist of twice three wires of 50 sq. mm. cross-section, alone amounts to 640 tons.

Apart from the high pressure used and the record distances of transmission, this plant is of special interest, because of the size of the generator and transformer units.

The Molinar central station has been designed for five generators each of 5,625 K.V.A. at 6,600 volts and 428 R.P.M., three of which are at present installed (fig. 3). The armatures of these machines carry former-wound coils, beyond which project the cast-iron housings on both sides. The magnet wheel comprises 14 cast-steel poles of rectangular cross-section, fixed on the rim by means of dovetails and wedges, and provided with laminated pole shoes. The magnet coils are made of flat copper wound on edge, and are fed from exciters driven by special turbines.

The pressure of 6,600 volts is raised by five three-phase transformers (three of which are at present installed) to

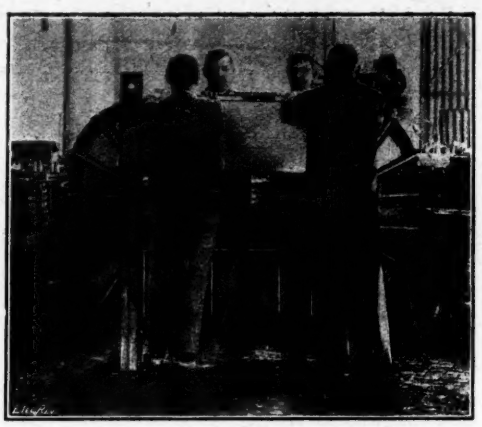


Fig. 2.—High-pressure Coil of 6,750-K V.A. Transformer.

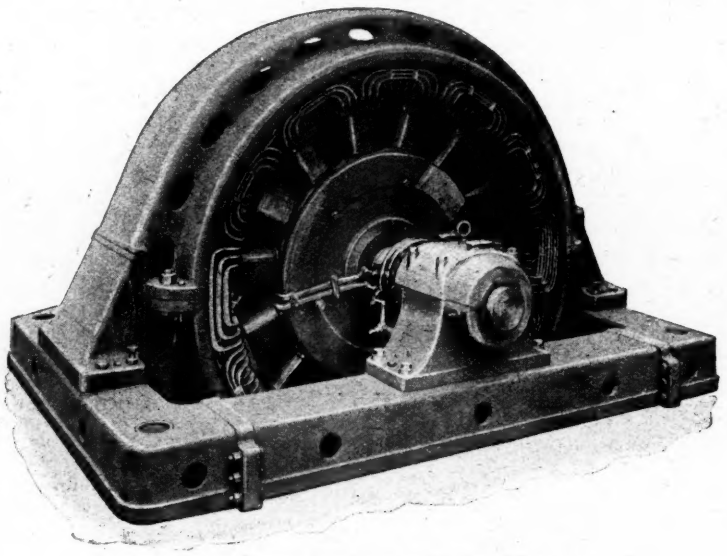


Fig. 3.—Three-phase 5,625-K V.A. Generator.

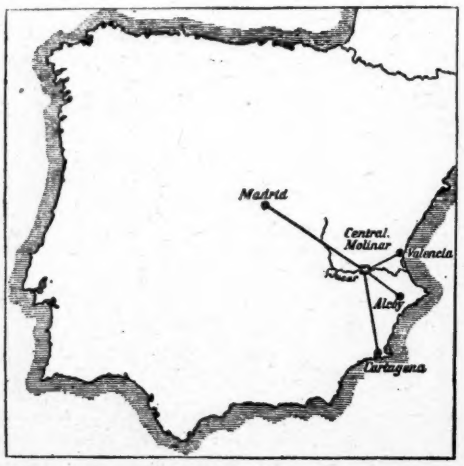


Fig. 1.—Map showing the Transmission Lines.

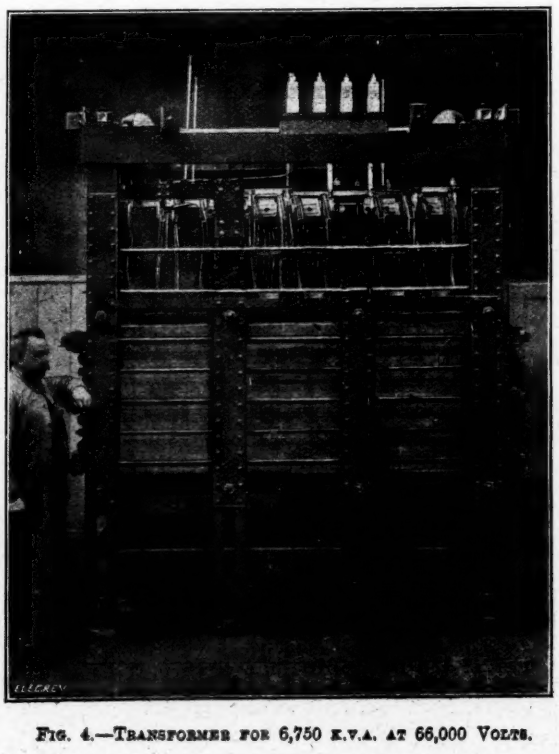


Fig. 4.—Transformer for 6,750 K.V.A. at 66,000 Volts.

66,000 volts. The output of each transformer is 6,750 K.V.A. at 50 cycles per second. They are of the shell type of transformer with three phases (in two sections each) arranged beside one another on cores. Fig. 2 represents one of the disk-shaped high-tension coils in the workshops.

Oil cooling is provided for eliminating the heat evolved (fig. 5); the oil is propelled by an electrically-driven pump through coiled piping surrounded by flowing water.

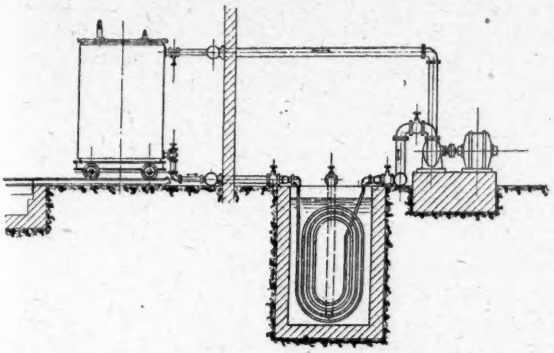


Fig. 5.—Arrangement for Cooling the Transformers.

Fig. 4 gives a striking idea of the huge dimensions of the transformers, the total weight of each of which is 38 tons, of which 21 tons corresponds to the transformer proper, 6 tons to the oil reservoir, and 11 tons to the oil.

This remarkable pressure of 66,000 volts is likely soon to be exceeded by even higher figures, going as far as 100,000 volts, a value hardly as yet attained even in American practice.

The plant above described has been constructed by Messrs. Siemens-Schuckert Werke, of Berlin.

THE STATUS OF THE ELECTRICAL ENGINEER.

By TITO.

Kelkun was until recently a "tonsorial artist," and belonged to a union. Now he is, I find,

M. Kelkun,
Electrical Engineer,
Specialist in Electric Depilation.
Quelpart.

He has abandoned his union, has become a professional gentleman, and no longer "goes to his shop" but "attends his office." Kelkun is young, and socially ambitious.

I have the honour of knowing Kelkun in his depilatory capacity, and, recognising in me a brother professional, he has confided to me his ambition, the example which fired it and the dazzlingly simple means by which he hopes to realise it.

Kelkun, sen., is a politician in a small way, with a fine gift of wire-pulling and a pretty knack of municipal oratory; consequently he is a member of various public bodies. As such, he assisted lately in the election of an electrical consulting engineer. The thing had been flagrantly a job.

"Coquin worked the job well—them London fellows with their tails of letters after their names had no chance against him—ay, and he'll get the letters himself by and bye, like Z. did," said Kelkun to me, rejoicing in the success of a fellow graduate with the self-conferred degree of E.E. of the University of Nulpart.

This University, whose curriculum at one time embraced all professions, has had to abolish its chairs one by one until now—the chair in dentistry having recently gone—it specialises in engineering, a damnified Charlottenburg, compensating itself for restrictions in other directions by increased activity in this one.

The feature in this self-conferred degree of Nulpart, which most attracts Kelkun—after the cheapness—is the freedom from any embarrassing rules of professional etiquette. A doctor may starve behind a decorous brass plate without the assistance of one small sandwichman; Coquin has used the equivalent of a brass band, and Kelkun may have in his mind the addition of a torchlight procession.

As I have no real desire for the competition of Kelkun, I have tried to tempt him into other professions; I have suggested law, medicine, the church, dentistry, veterinary surgery, pharmaceutical chemistry, the civil service, and others. Not one but has a selection net of too narrow a mesh for Kelkun's compendious ignorance and—stronger reason still—in none would Kelkun senior's influence—"pull" he calls it—be effective.

I fear Kelkun will succeed, and will be serenely ripening for a pension in a snug municipal job, after an arduous 20 years spent in engineering successive rises of salary, or will be figuring in the local Press as "that eminent engineer, Mr. Kelkun," when I shall be haggling with the pension officer for the full 5s.

I was much struck by my friend Kelkun's comment when I suggested pharmaceutical chemistry as a promising field for his ambition. "I would have to pay £100 and work a pestle and mortar for two years, and then if I didn't pass their rotten examinations I could never build a pill or mix a draught on my own"—to which I add, and a wagon load of testimonials as to the proved efficacy of his pills and potions would not make him an L.P.S.

He could not become a solicitor by the drawing of uncontested wills, nor a surgeon by successful bone-setting, nor a priest or parson by the united testimony of all the old women of his parish to his grace and orthodoxy: successful cow-doctoring would not make him a veterinary surgeon. The Government wouldn't allow him to lick its stamps, as a boy copyist, upon the sworn testimony of the parson, the schoolmaster and two J.P.'s.

The principle common to all these professions is simple: The governing body *satisfies itself* by direct examination (1) that the candidate possesses the necessary intelligence and education (matriculation, let us say); (2) that he possesses the necessary capacity in the particular line chosen (graduation), and the height of the standards is a rough measure of the grade of the profession. In no case known to me—except engineering—does the governing body of a learned or semi-learned profession allow the practice of the profession on trial, or admit graduates of Nulpart *ad eundem gradum* on any terms.

Kelkun would be impossible as a chemist: he is not impossible as an electrical engineer. I submit that he should be impossible, in the interests of a grand profession which his adoption will disgrace, and in the interests of the public purse which his incompetence will plunder.

I would suggest two immediate steps to this end:—

1. The imposition of a matriculation examination for the grade of Student.

2. The imposition of a graduation examination for the grade of Associate Member;

and one in the near future:—

The application to Parliament—in conjunction with the governing bodies of the Civil Engineers, Mechanical Engineers and Architects—for a short Act prohibiting the payment of public money—on and after a certain date—for services as an engineer or architect above a certain low maximum weekly wage to anyone not then on the Register of these governing bodies. Vested interests being duly safeguarded.

Sooner or later, engineers and architects will have to seek legal protection for their accredited members—such as is enjoyed by every other profession; but they cannot claim the protection due to their standing as professional men, with a definite standard of education and knowledge, and a code of professional etiquette, until they have taken steps to enforce the standard and the code.

Baillieborough (Ireland) Lighting.—A scheme for the electric lighting of this town has been adopted by the inhabitants, and the cost will be met by a charge of 3d. in the £ on the area concerned.

D

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Re Slow Speed Starters.

In looking over the pages of your paper dated January 1st, my attention was arrested by a full-page advertisement putting forward very boldly a starter with slow-speed attachment. A few pages farther on, this starter is described under the heading of *New* Electrical Devices, &c.

I have followed with keen interest the development which has taken place during the last 10 years in the design of starting and controlling gear, and after glancing at the illustration and reading the description of this *new* starter, I thought I had seen a similar device patented before.

Looking over the Patent Office specifications relating to starting switches, I found two patents almost exactly similar to the one described in the current issue of your paper; one invention was filed under the Patent Acts in 1899, its number being 23,371; the other one was patented in 1906, No. 4,773. After going through these, I found that the starter advertised in this week's issue of the ELECTRICAL REVIEW is a very feeble imitation of the above two patents, and I entirely fail to see how the word *new* is applicable to this apparatus, having also in view the fact that a description of a similar type of starter, manufactured by a different company, appeared in your columns over a year ago.

Patents.

January 5th, 1909.

[On inquiry from the makers of the apparatus in question, we are informed that their slow-motion starter is fully protected by master patents, and contains elements of novelty. We may add that, under the existing Patents Act, letters patent cannot be obtained in this country for devices which are devoid of novelty and invention, an official search being made to ensure this.—EDS. E.R.]

The Gardiner Cab Signal.

May I beg the favour of a few lines regarding the article so kindly printed in your issue of November 13th last, on the subject of my proposals for the control of railway traffic by means of signals in the engine cabs, instead of, as at present, on the track?

You say, in speaking of the paper read at Leeds and the model that was exhibited there: "It was all very pretty—and impracticable."

You go on, however, to show that this charge of impracticability is based upon the assumption that the presence of the human element upon the track for the purpose of performing the manifold duties that the signalman now carries out, in addition to that of indicating its state, is in some way precluded under my proposals.

A closer perusal of my paper, a reconsideration of the traffic operations illustrated by means of the model, will show that this is in no way either involved or suggested.

May I refer you to your own quotation and underline one of its clauses: "With automatic signalling, *as far as indicating the state of the track is concerned*, manual control is not only superfluous, but undesirable."

All I propose to do is to faithfully represent upon the locomotive the state of the track, leaving it to the master mind of man at junctions and stations to direct such operations as the re-arrangement of traffic, "selection" and shunting.

The model, of course, is a small thing, but those who have seen it will remember that the points were pulled by human agency; human agency determined whether or no the train should be admitted to the station, and which of the two should start out from it.

Automatic signalling does not claim to abolish the presence of man at those parts of a railway where duties are to be performed other than those of signalling the passage of trains; yet even there, more especially when coupled, as it usually would be, with power working, it so lightens the man's labours, expedites the operations, and relieves him of anxiety, that the experience of those lines that have tried it has been that it enables more work to be done with greater safety by fewer men.

You say—doubtless with the same idea in your mind as I have endeavoured to combat above—that "Capt. Gardiner's system . . . . is impracticable . . . . because . . . . it has not the flexibility to meet the varying conditions of operation on railways."

My now nearly 16 years of work on railways have been spent in a country where the single track is still in a huge majority; a land where in the great bulk of the stations each and every track is liable to be used indiscriminately by up trains and down trains. If any conditions of traffic call for a flexible system of interlocking and signalling, they are these. Yet it is perfectly feasible to carry my proposed system through such a station, and leave the human element entire freedom to carry out every conceivable operation save that of signalling two trains into the same siding head to head, or a following train into an already occupied siding.

You refer to an "ineradicable defect"—that the failure of a cab signal will retard the train throughout its whole journey. To a modified extent this is true; so it is of the automatic brake. Yet the risk of the automatic brake occasionally retarding, as it does, a train has not prevented its addition to its equipment. Being part of the locomotive itself, there is no reason why the mechanically simple cab signal should go wrong any more frequently than the rest of the far more complicated mechanism of a modern steam engine.

Finally, you have raised the objection of the capital burden of the old "scrapped" system. Yet these things must be. Old systems must give way to newer methods, introducing greater safety to the public and better utilisation of existing lines. New lines cannot be tied for ever to old methods solely lest the old lines should have to "scrap" plant that yet has some years of life in it. The introduction will, no doubt, be gradual, but it has already begun in the automatic semaphore, which has made good its footing on many English lines; and different as our English conditions may be to those in America, we all have one great link in common, be it in England, America, Europe, or India, and that is the ever present risk of disaster to those who are in our charge.

Apologising for the lapse of time since your article appeared, which has been due to my having returned to the East; and for the length of this letter.

A. Gardiner,
Capt. R.E.

Roorkhi, India, *December 8th*, 1908.

[Capt. Gardiner does not give any further particulars of his system than have already appeared, so that its applicability to more onerous conditions than the simple case shown by the diagram in his Leeds paper cannot be tested. Capt. Gardiner disclaims any intention to abolish human control of the track-circuit at junctions and at other places where such control is necessary; the system then ceases to be automatic, and cannot be correctly described as one in which manual control is not only superfluous but undesirable, as far as indicating the state of the track is concerned.

As Capt. Gardiner cannot have seen the letters of Col. Gardiner in our issues of December 4th, 11th and 18th and our contributor's remarks thereon, when writing his letter of December 8th, we do not propose to comment further on the subject at present.—EDS. E.R.]

Silence is Golden.

If anybody took my letter quite seriously, and had the faith to believe the facts, surely it was of interest to my "professional brethren"? Does it not show that any person with either a little influence, or the "gift of the gab," can (regardless of his knowledge or ability) obtain positions which he is not fit to hold, and in this way can enter the Institution of Electrical Engineers, and become even a member? A member of the Institutions of Civil or Mechanical Engineers is either a civil or a mechanical

engineer, but it cannot be said of all the members of the Institution of Electrical Engineers that they *are* electrical engineers.

However, the editors should have consulted "Another Ignoramus (possibly)" before they published my letter, which I grieve to learn wasted their time, their printers' time, and last, but not least, the time of "Another Ignoramus (possibly)," which, to judge by his remarkably clever and sensible epistle, and his fitting *nom de plume*, must be very valuable.

I will take the opportunity of informing "Nous Verrons" that one cannot *write eloquently* any more than one can *walk* eloquently. He should get and study an English grammar, and leave his French dictionary alone for a bit!

A. J. Abraham.

Cambuslang, *January 9th*, 1909.

Your correspondents "Another Ignoramus" and "Nous Verrons" appear to have but a small sense of humour. Surely it is no sin to publish, for the benefit of others, amusing examples of ignorance displayed by so-called engineers. Not only in central station work but also in manufacturing concerns does one come across men of a similar type to the chief engineer mentioned by Mr. Abraham. Another example might be quoted.

In a well-known firm of electrical engineers one of the chief technical men made the following statements:—"That a four-pole motor with a two-circuit winding could not be run with four sets of brushes" and "in order to reduce the speed of a *series* motor the field should be coupled in parallel." Such instances as these go to prove that now-a-days many positions are obtained by influence, and not by technical ability.

E. E. P.

["Silence is Golden." This correspondence is now closed.—Eds.]

Appointments Provided.

We still read in the "Faraday House Journal" that "with very few exceptions appointments have been found for every proficient student who has completed the course since the opening of the Institution."

Would Faraday House kindly favour us with the *average* salary obtained by their "proficient students?" The fee is, I think, £315 for the four years; add to this, say, £80 a year for board, &c., and we have at the very least £635 to spend before our son is a "proficient student," although £720 would be nearer the mark. However, suppose I spend, say, £635 on my son, and suppose he becomes a "proficient student," what salary will he get? It is a well-known fact that some of the appointments obtained by Faraday House for "proficient students" carried with them the magnificent salary (*sic*) of 15s. a week, and their fathers have had to go on keeping their sons. Will Faraday House, for the benefit of parents, tell us the *average* salary they have obtained for their students for the past two years?

Again, Faraday House state that in central station work "the inquiries have exceeded the men available" (during 1908). Now, we all know how few and far between during the past year have been advertisements for central station posts of the value of £100 a year and upwards. What, again, was the average salary Faraday House managed to obtain for ex-students during their own prosperous year of 1908? I do not for one moment question that Faraday House do find all these posts for both their "proficient students" and "ex-students," but I do fear that they are helping to increase the already huge body of electrical engineers who are compelled to work for 10s. and 15s. a week, when they are worth at least a living wage of £2. Salaries in central station work have been going down steadily for 10 years, and this work will soon be only a hobby for the wealthy.

Ohm Sweet Ohm.

Meter Books and Ledgers.

With reference to an article on this subject by Mr. Petersen, which appeared recently in your columns, and in which he advocates the loose-leaf system, I would like to point out an important objection to its application to the more important clerical work of an electricity supply department. In the case of loose card meter-reading books or loose-leaf ledgers, the loss of a single card or page may have serious consequences, as the information thus lost very probably cannot be obtained from any other sources. The page may become detached through ordinary wear and tear, or it may be removed for purposes of reference and its return to its proper place forgotten. As in most places the consumers' ledgers are started afresh every year, there is not much advantage to be gained in adopting the loose-leaf system. In the ordinary bound ledger, the above cannot take place, and there is no possibility of tampering with any entries. If the card system is adopted for meter-reading books, the cards as they get filled up should be transferred to card cabinets, to which only two or three responsible persons have access.

W. A. Toppin.

Greenock, *January 10th*, 1909.

Municipal Ideas.

When will ratepayers realise the importance of placing men on their councils and committees who have their interests at heart, and not the petty fads so often being put forward, which the ratepayers are called upon to pay for?

Another case which must open the eyes of those will be called upon to bear the expense has occurred in a town situated not far from Ipswich.

A general manager appointed to a tramway undertaking has (or should have) sufficient experience to enable him to advise the committee on the management of the undertaking, but when the committee ties his hands, and one hears such ridiculous proposals as that put forward by a member of the committee in question—that in order to assist the receipts, strangers and visitors to the town should be charged double to travel from the station to the town and residents pay the usual fare,—it must disgust a practical manager who has any interest in his work, and has brought excessive expense to an over-burdened

Ratepayer.

Pay-as-You-Enter Cars.

While reading your article on the P-A-Y-E cars, now being installed in America, I thought perhaps you would like to know that that system was in vogue in London as far back as 1881-4 on the South Metropolitan Tramways. It was a one-horse single-deck car with a carrying capacity of 20 passengers when full, and used to run from St. George's Church, Borough, to the Canal Bridge in the Old Kent Road, fare 1d.

On entering the car, you used to walk right along and place your penny in a slot, and it fell on to a plate fitted with a tripping arrangement at the driver's back, and when all the fares were paid, he pulled a small lever, which tripped the plate and shot the coppers into a cash box underneath, which was emptied at the end of each journey. There was a small trap in the door, and if you had not got any change the driver would hand you change for anything up to 2s. 6d. The box was fitted with a glass front, so that the driver could count the coppers that fell on the plate.

H. Phillip.

Sub-Station, Hythe,
January 11th, 1909.

London County Council Turbines.

The letter in your current issue signed by "Concilio et Labore" fills me with amazement! That an Englishman (?) earning his livelihood in Germany, however much to his regret, should write such a letter as this astonishes me!

His remark that the Germans only want from us "our good money" is amusing in view of his own example.

The wild talk of a boycott suggested by your impetuous and narrow-minded correspondent would do us infinitely more harm than we should effect on Germany. He is, perhaps, unaware that the exports from the British Empire *into* the German Empire for the year 1907 exceeded in value the goods we received from Germany by more than £23,000,000! The insular prejudice against anything

emanating from Germany at the present time is becoming almost a disease amongst some of us, and the expression, "made in Germany," has become the epithet applied to anything that is cheap and nasty.

During my six years' experience as an inspecting engineer (five of which were spent with one of the leading Westminster consulting engineers) I have had the unique opportunity of inspecting electrical machinery, including turbines, steam engines and dynamos, as made by practically every first-class engineering firm, both in this country and on the Continent, and I have always found that the machinery from the first-class manufacturers on the Continent favourably compares both in regard to reliability, workmanship, economy, and in every other respect, with that of the leading British manufacturers.

I consider that Corporations, as a body, should deal with contracts in the same spirit as they would do if they were ordering and paying for the plant themselves, viz., accept the one which shows the greatest advantage in regard to economy and reliability, and, lastly, price. If this were done in every case, I am sure that more orders would be given outside the country.

I know of a German firm who have received some very large repeat contracts in this country which have not been given to them on the score of price, but purely and simply by reason of the extreme reliability and high efficiency obtaining in the plants which they have installed.

Percy W. Turner,
Inspecting Engineer.

Manchester, *January 11th*, 1909.

House Service Switches.

I am glad that my letter in your issue of 1st inst. has induced at least two makers to send you particulars of automatic transformer switches (*vide* issue of 8th inst.); but neither of these appears to be the make referred to by you in your note to my letter. Will other makers, therefore, very kindly disclose themselves?

As mentioned in my letter, I consider there is an opening for electrically-operated house service switches; that is to say, switches which may be opened or closed from a distance by pushing a push button.

The automatic transformer switch fully described in your current issue apparently could not be used with a balancing or with a two-winding transformer; but an electrically-operated switch would *partially* get over this difficulty.

In other respects also a simple electrically-operated (air break) service switch would be convenient; and I, for one, should be glad to have particulars of any design for such, even if it has not been made up for the market.

W. Perren Maycock.

London, S.E., *January 9th*, 1909.

[The switch to which we referred was that made by Messrs. Neville, Williams & Co.—Eds. E.R.]

Cheap House Wiring.

I must express my surprise that Mr. Maycock should have imagined such a warm rejoinder to my letter to be necessary. Mr. Maycock went for the man who allowed a £10 note to intervene between himself and happiness, and for gas and gas fittings which were destroying his own happiness, and did so in a very humorous way; and all that was attempted in reply was to show in the same way, how gas itself can be made to bring happiness.

The letter did not contain either grumbling or abuse, or any estimate of cost either for installing or running such a plant, because it was made by "T. J.'s" own firm, and the proper place for such particulars is the advertisement columns.

If Mr. Maycock had been sufficiently interested to wish for further particulars, he could have had them sent privately, but perhaps he prefers his gas to such a "toy." A similar "toy" engine and "toy" dynamo have been used to light a ball room at a nobleman's mansion, when a considerable number of "Royalties" were present. There were 140 lamps of 8 c.p. in use, and that nobleman did not look on the matter as a doll's house and toy business by any means; the same plant is to-day lighting a shop and offices in a busy thoroughfare in London. Another of these "toy" engines is driving a dynamo which is lighting a workshop and is also driving a line of shafting, a 30-cwt. iron turning lathe, a heavy drilling machine, a brass-worker's lathe and a grindstone.

It really would seem that any man who steps out into the open with a new thing in the electrical world is much more likely to be shot at by people wearing his own uniform, than by those in the uniform of the enemy—gas.

T. J.

[This correspondence is now closed.—Eds. E.R.]

The Craze for Cheap Wiring.

Mr. Russell's admirable article on the above subject in your last week's issue, so lucidly and convincingly places the case before your readers, as to leave little more to be said by those who are in agreement with him.

There was, some years ago, a lengthy correspondence in the *Times* on the subject of the Fire Office Rules, one of the results of which was undoubtedly to strengthen the rules of the various fire offices, and to bring them into line where they materially differed with those of the Phœnix Co.

The reasons for demanding the relaxation of those rules are so undisguisedly advanced for the benefit of some of the supply companies, and of certain municipal undertakings, that the question of danger to the general public appears to stand in need of some advocacy.

It is alleged that the cost of installation is artificially maintained by the stringency of the fire office companies' rules, and that their relaxation would induce the small householder to become a customer of the electric supply companies. As to whether such a step would have the desired result so far as the small householder is concerned, is open to question. I do not for a moment believe that it would.

The Fire Office Rules have been for many years accepted as standards by the supply companies, who have in their own regulations, imposed them on prospective consumers, and in many instances have specifically forbidden the use of flexible cords in any situation whatsoever, except for attaching a movable lamp to a wall socket.

During the conversion of several of the large London stations from a 100-volt supply to 200 volts and upwards, these rules were so rigorously enforced that the supply companies, recognising the necessity of their observance, themselves bore the enormous cost of bringing their customers' wiring up to the standard of safety which the application of the rules demanded for the increased pressure.

Nothing has occurred to change those conditions. Nothing has occurred to render what was unsafe then, safe now.

It must be remembered that there are hundreds of country houses which have their own electrical machinery, and if the Fire Office Rules are to be relaxed for the small consumer they must surely be so for the greater, and for the owner of the country house who generates his own electricity.

The mysterious fires which have of late years destroyed so many country houses of almost national interest would, it is to be feared, be very largely increased.

The experience of many years has clearly demonstrated that methods which are suitable to other climates, other conditions of life, and considerable structural differences in the buildings, are not only unsuitable but highly dangerous in this country.

I have during more than a quarter of a century of practical experience in these matters both seen and heard of fires that have been caused by the use of flexible cords in unsuitable situations.

In this matter the Fire Insurance Companies are the trustees of the public safety, and it is to be hoped that under no circumstances will they sanction any relaxation of rules which, where they have been carefully observed, have ensured safety and security, while where they have been neglected or overruled disaster has inevitably followed.

Thomas O. Belshaw.

Westminster, S.W., *January 12th*, 1909.

A correspondent asks for particulars of the most efficient system of street lighting by overhead wires to lamps suspended above the centre of the street; the overhead connections being supplied from the ordinary underground mains.

"Alpha" asks whether there is a school in London or the provinces, other than the well-known science colleges and universities, where up-to-date dynamo design is taught during the daytime.

Several letters have been received too late for insertion.

LEGAL.

Westminster Electric Supply Corporation, Ltd., *v.* L.C.C.

The adjourned proceedings in this Arbitration action were resumed at the Surveyors' Institute, Great George Street, Westminster, on Friday, January 8th, before Mr. Simon, K.C., M.P., Umpire, and Messrs. Young and Falconer, Arbitrators.

At the outset Sir Edward Clarke, for the L.C.C., questioned whether the Arbitrators were competent to hear the case at this point under Sec. 31 of the Lands Clauses Act, which set out that if the Arbitrators had not formed a decision on the matters referred to them within 21 days from the last sitting, they had no further power to act, and the matter would have to be referred to the Umpire. The Arbitrators had not submitted a decision, and he, in consequence, raised an objection to their continuing. Sir Edward said that he had a strong objection, and in reply to Mr. Balfour Browne, said that he also objected to the renewal of the Arbitrators.

Mr. Balfour Browne, K.C., for the Westminster Supply Corporation, said that he understood that the Arbitrators had not differed, and it might be possible for them to have agreed. If that was so then the Umpire did not exist.

Sir Edward Clarke stated that the Arbitrators' time expired on January 1st, but Mr. Browne replied to the effect that it was not their fault that the case was not concluded, but he understood that it was adjourned to that day to suit the convenience of some of those concerned in the matter.

Mr. Simon was of the opinion that they were not within the scope of the Lands Clauses Act, but Mr. Browne replied that with regard to some sections they were.

Mr. Falconer, one of the arbitrators, intimated that he was perfectly willing to abide by the section referred to, but offered to remain unofficially.

Sir Edward Clarke, however, said that he could not agree to that, and continuing, said that an agreement would probably be come to between him and his learned friend on some points, and he thought they should be allowed to confer together before the Umpire exercised his right. Some points would undoubtedly be agreed to.

Mr. Simon expressed his willingness to allow that.

Mr. Browne asked Sir Edward Clarke whether he would agree to the arbitrators sitting, not as such, but as assessors in the case, but the latter said that he could not consent to that. Mr. Browne admitted that there appeared to be a difficulty in the matter. Eventually, after some further discussion, the arbitrators withdrew, Sir Edward Clarke intimating that they (the L.C.C.) preferred to address themselves to the Umpire.

Mr. J. F. C. Snell was then re-examined, and replying to Sir Edward Clarke, in reference to the question of coal consumption based upon the probable output of the works during the forthcoming year, said that since the previous hearing he had had an opportunity of re-considering the diagrams that were then produced, and had more fully gone into them. Some inaccuracies had been corrected, and the four maximum demands, which should have coincided with a straight line, had been corrected, and the result was a slightly lower load factor in their favour. During the last five years, the Westminster undertaking, though there had been an increased demand for power, had shown no apparent increase in load factor. The kw. demand, said Mr. Snell, upon the motor-generators was practically the same in the case of an 11 per cent. load factor and a 19 per cent. load factor, the units generated being the only thing that differed. In cross-examination by Mr. Balfour Browne, witness said that it would not be economical for them to increase their steam plant. Mr. Browne pointed out that in 1897 the station load factor was 15·25, and at the end of 1907 it worked out, from the maximum load during the year, at 19·92, which was different from Mr. Snell's figures. Mr. Snell admitted that there had been a steady increase in the table, as mentioned by Mr. Browne. He stated that he based his annual estimate in kilowatts upon existing statistics.

In answer to Sir Edward Clarke, dealing with a table setting out the units generated and the maximum load for a series of years, Witness admitted that if he were to transfer the maximum load from one year to the next year, it would be wrong in six cases out of ten. It was pointed out by Sir Edward, that, as he had it, the maximum station load factor for the last five years was 18·64, and in 1904 that was the figure which would be arrived at on examination. Mr. Snell considered that this was a very generous load factor for a residential district.

Mr. Howard Martin (President of the Surveyors' Institute) was examined by Mr. Balfour Browne upon the table dealing with the cartage of coal as affecting the question of compensation.

Mr. C. H. Gadsby was also re-examined, and said, in reply to Sir Ed. Clarke, that he had prepared an estimate of additional output and coal cartage costs, and had reduced it to a table, showing the units sold per annum from 1897 and the estimate up to 1931. In stating how he had dealt with the increase of units after 1907, Mr. Gadsby said that the figures were the annual output, and were based on information that he had been supplied with. He pointed out that it must be recognised that in a district which was largely of a residential character the demand must at one time reach a limit. Continuing, he said that he did not think that Mr. Snell's curve set out on a diagram showed the exact nature of the increment which might be expected, and in regard to Mr. Hordern's curve on the same diagram, he was of opinion that it started at too high a place—in 1910. In 1907 the units sold were 4,870,000, and he had allowed an increase of 700,000 units per annum to 1910, when it was expected to produce 7,000,000 units. He (Mr. Gadsby) was not of the same opinion, and thought that at 1910 it was about a million too high. He thought that the increase should be reduced as the neighbourhood filled up. Since the introduction of motor-generators in 1903, the company had increased fairly regularly each year the number of units taken from the Central Co., and had apparently used about the same number of units generated by steam. He thought that the company were entitled to say that they proposed to use steam plant at Millbank, and take less from the Central Co. At 1913 they came to 9 million units, and he had not gone beyond that, because he estimated that 4 million steam-generated units per annum was the maximum which the present plant at Millbank, with additional plant of a similar class to be erected upon vacant places there, was able to generate. The present steam plant at Millbank was 2,536 kw., and there was space there for three further sets, which would provide an additional 675 kw., making a total of 3,211 kw.

Replying to Mr. Browne, Mr. Gadsby said that in a district like this, the supply could not go on increasing. Asked by Mr. Browne whether he was aware that there was a steady increase in gas consumption, despite the competition of electricity, Mr. Gadsby replied in the affirmative, and said that he thought that electricity could be far more used than it was, but not in this district. Mr. Browne pointed out that in his (Mr. Gadsby's) table, the units sold in 1897 were put at 1,005,068, and in 1907 at 4,870,428, the difference being 3,865,360, which was the increase in 10 years. From the 4 million odd in 1907, the figure to 1926 was put at 8,720,000, the difference being thus about 3 millions, so that in 19 years it was less than what it was in 10 years. Mr. Gadsby admitted that that was so, and that there was nothing extraordinary in that. Asked by Mr. Browne whether he was aware that for some years past the company had been practically under notice to quit the Millbank premises, and that was the reason that they had not put in more new machinery was that they knew that eventually they would have to go, Mr. Gadsdy said that he was not aware of that fact.

Mr. J. H. Rider, electrical engineer to the L.C.C. tramways, in answer to Mr. Morten, said that he had been associated with Messrs. Gadsby and Snell in the preparation of the new scheme and agreed with what had been said by them. He was of the opinion that the plans for the company's new station were too elaborate and costly. Speaking of the tenders generally, as to contingencies which Sir Alex. Kennedy had put at 10 per cent., he thought that if an allowance were made in each tender for contingencies, there should not be a general contingency figure in addition. He would not disagree with 10 per cent. if it covered everything. Replying to Mr. Morten's question, he said that spare parts, when they were delivered, were allocated to revenue account. £7,260 was the estimated cost each year for motor-generators; that worked out at about £2 10s. per kw. on 2,000 kw. This, he thought, was too high. Referring to switchgear, he had put that in at Greenwich at a cost of only 14·8s. per kw., and in the sub-stations the cost had been about £1 per kw. He had seen that at Eccleston Square the cost had been £2 9s. per kw., Duke Street £2 per kw., and at the Great Western Railway station £3 5s. per kw. He thought that the switchgear had been lavishly designed, and money had been spent unnecessarily. He guaranteed that it was possible to design a switchgear of equal stability, and equally able to do what was required, at the figure which had been given for their own station. His own costs of the switchgear included all brickwork, &c., but not the gallery. The cost of a switchgear in a sub-station would be about £500, though it could be done for less. Regarding high-tension switchgear cable charging devices, in three cases where he had put these in he had taken them out again. He considered that such work was unnecessary and unadvisable.

Cross-examined by Mr. Balfour Browne, he said that he did not know that the contractors had been kept waiting about two years. He believed in switchgear of the simplest possible character, but this was only a matter of opinion. Double sets of bus-bars were unnecessary. Mr. Browne pointed out that the switchgear, from their point of view, was not as described by Mr. Rider.

Sir Edward Clarke, at the conclusion of this witness's evidence, said that that was all the testimony he proposed to put in.

Mr. Peach, architect, was then re-examined by the Hon. A. Lyttleton for the Supply Corporation in reference to the plans of the Millbank and Horseferry Road premises and their cubical contents, and said that he disagreed with Mr. Stewart, architect, as he had measured over a larger area than was necessary.

On Saturday, Mr. Peach (the Corporation's architect) was further re-examined.

Sir Alex. Kennedy, consulting engineer to the Corporation, supported Mr. Peach's contention, and in regard to 14,800 sq. ft. superficial area on the ground floor at Horseferry Road, said that with the exception of some 1,250 sq. ft. for the ash-conveying plant, the space had only been calculated once. The space for the ash-conveying plant had been included twice. Dealing with the high-tension switchboard, he said, in reply to Mr. Shaw, that there were two main differences between him (Sir Alexander) and Messrs. Gadsby, Snell and Rider, and they were that double bus-bars were not required nor charging-gear. He was sorry to differ from them. He and his colleague had put up a number of sub-stations, and they had found that charging-gear and double bus-bars were essential,

This was to bring up the pressure gradually through the cables, and not put it on suddenly. They had had a number of breakdowns. At Grove Road, which he had had some connection with, they had the same load factor, about 36, as he proposed to use at Horseferry Road. He thought that Horseferry Road would be just as economical as Grove Road, because they would save 15 per cent. on every unit before it was transformed, whereas at Grove Road they had to bring it down. Where they had had an average load factor of 19 per cent, they worked Grove Road with a load factor of about 32 per cent., and he found that that was economical. For some months they had had a 36 per cent. load factor.

This concluded the evidence, and in laying before the Umpire the L.C.C.'s case,

Sir Edward Clarke said that the matters generally resolved themselves into five distinct questions:—

(1) What proportion of the building expenditure at Horseferry Road is to be borne by the L.C.C., and what sum is to be paid by them in respect thereof.

(2) As to the cost of the plant which is to be put into Horseferry Road and for which the L.C.C. are to pay.

(3) The amount to be paid to the Westminster Corporation in respect of the extra expense of mains.

(4) The question of the supply of water facilities which they may, by Act of Parliament, give, and had given, to the Corporation.

(5) The question of the liability, under Act of Parliament, to pay a sum representing the increased burden which will lie upon the Westminster Corporation in respect of the increased expenditure upon the cartage of coal.

He went into these various questions, and Mr. Balfour Browne submitted the case on behalf of the claimants.

THE GERMAN ELECTRICAL INDUSTRY.

The Proposed Electricity Tax Causes a Diminution in Orders.

If the electrical engineering industry in Germany be regarded as a whole, it may be said that it suffered much less from the general decline in economic prosperity in 1907 than the iron and steel trades, which are not so well able to accommodate themselves to the course of downward movements. The electrical trade derived advantage from the fall in the prices of iron, copper, tin, zinc, lead, &c., and although stocks had to be written down on the one hand, on the other benefit was obtained from the reduction in the cost of production. If to this fact is added the circumstance that the greater portion of the trade is vested in the hands of three or four firms, and that these are closely associated with each other, it is not surprising that the turn of unfavourable trade has not shown any particular manifestations down to the present time, at all events, in regard to the leading manufacturers. But the projected tax on electricity is exercising a prejudicial effect upon new business, and no one would venture to predict what may really happen should the imposts become an accomplished fact.

The accounts of the Siemens-Schuckert Works Co., which comprises the heavy electrical engineering departments of the Siemens and Halske Co. and the Schuckert Electricity Co., show that the latter now holds £2,247,500 out of the total share capital of £4,500,000, and the S. & H. Co. owns the remaining £2,252,500. According to the directors' report, the works were satisfactorily employed during 1907-8, notwithstanding the general decline in industrial prosperity, and the value of the turnover was greater than in the preceding year, despite the reduction in the prices of manufactures which had taken place. The principal financial figures are set forth below:—

	1907-8.	1906-7.
Capital	£4,500,000	£4,500,000
Obligations	990,500	1,000,000
Gross profits	750,908	866,079
Expenses...	64,721	61,368
Depreciation provision... ...	133,142	270,500
Net profits	509,745	508,276
Bonuses to officials, &c.... ...	40,000	40,000
Benevolent fund for officials and workmen...	17,500	17,500
Profits of the two proprietary companies	450,000	449,329
Profits, per cent.	10	10

The report states that generators and motors for still more complicated requirements and larger outputs were demanded during the year. Motors of a capacity up to 12,000 h.p. for heavy rolling mills were set in operation with complete success, and machines were supplied which dealt with from 12,000 h.p. to 16,000 h.p. at a speed of from 300 to 500 r.p.m., whilst five transformers, each for 9,000 h.p. at 70,000 volts, were also delivered. In the case of main winding engines, which afforded the company abundant employment in former years, orders had repeatedly been postponed recently in consequence of the proposed electricity tax. The adoption of electric driving in textile factories continued to increase, and this method had been almost exclusively introduced in printing works. Among other industries the report specially mentioned large installations for cement, engineering, and electrochemical works. An active interest was also manifested in the construction of overland central stations, and the company delivered turbo-dynamos, the turbines being of the Zoelly type, of individual outputs up to 7,500 kw. The experience gained with high-pressure transmissions up to 70,000 volts over distances up to 161 miles rendered it apparent that an augmentation of the pressure to 100,000 volts could already be taken into consideration. The railway department was better employed than in the previous year, and three of the alternating current installations were set in operation; electric locomotives only would be employed in connection with the order received for the conversion of the main line from Basel to Zell on the alternating current system at 10,000 volts and 15 periods. It appeared that the company's alternating current method with a low periodicity was destined to gain more and more the upper hand for the working of main lines, whilst the storage battery cars supplied to the Prussian State railways had resulted in orders for further equipments. The total deliveries of of generators, motors and transformers by the German works and those outside the country amounted to 51,857 of an output of 1,014,225 kw. It is stated, in conclusion, that the new financial year had witnessed an increase in orders, although the threatened electricity tax had caused great reserve in placing them, especially on the part of the heavy industries, and had consequently accentuated competition and induced depression in prices.

The shareholders in the Siemens & Halske Co. have approved the payment of a dividend of 11 per cent. for 1907-8, being the same rate as in the preceding year. According to the directors' report, the total value of the goods invoiced was about 15 per cent. greater than in 1906-7. The overcrowding of the Werner works rendered it necessary to make an extension which would be brought into use in the current year; whilst the iron foundry hitherto carried on at Pankow had been transferred to a new building on the Nonnendamm. The production of tantalum lamps in the glow lamp factory was considerably increased, and that of carbon-filament lamps was not less in the previous 12 months. An extension of the glow lamp factory was put in hand at the end of the financial year, and would shortly be opened. As far as concerns the Berlin Elevated and Underground Railway, the report mentioned that the new section from the Knie to the Westend was inaugurated on April 1st, 1908, and that from the Potsdam Platz to the Spittelmarkt on October 1st. An agreement was concluded at the beginning of the new financial year with the town of Schoneberg in relation to the construction of an underground line from the Nollendorf Platz to the Haupt Strasse in Schoneberg, and the work was already in progress. The company in association with the Allgemeine Co. had obtained a working concession for the city and suburban railways in course of construction at Hamburg. The cable factory at Florisdorf, near Vienna, was transferred to the Austrian Siemens-Schuckert works at the end of 1907. The accounts for the past two years reveal the following figures:—

	1907-8.	1906-7.
Share capital	£2,725,000	£2,725,000
Obligations	1,348,000	1,367,000
Gross profits	553,888	548,741
Depreciation provision... ...	23,619	68,870
Net profits	484,413	435,868
Dividend...	299,750	299,750
,, per cent.	11	11

It was mentioned at the general meeting that the works of the Cyanide Co. were already partly in operation and partly in course of development. The product promised to yield favourable results, but the progress was slow, as was the case with all similar articles. The electrical bank had not yet arrived at any decisions in regard to transactions, and no information could, therefore, be given on the subject. As far as the new year was concerned, the orders showed an improvement over the corresponding period of the previous year, although this was not uniformly the case with all departments; but, on the whole, the contracts were 15 per cent. higher than in the same term in 1907.

The directors of the Elektrizitäts Gesellschaft vorm. Schuckert and Co., of Nuremberg, whose accounts for 1907-8 have just been approved by the shareholders, refer in their report to the new issue of obligations made in the year, the emission comprising £750,000 in 4½ per cents., and the incidental expenses amounted to £31,000. The gross receipts from investments, undertakings and securities, were £29,400 higher than in the preceding year, and this circumstance is attributed to the increase in the company's participation in the Siemens-Schuckert Works, and the larger yield from the undertakings in which an interest is held. But the net profits were slightly less, apparently owing to the cost of the issue of bonds. The accounts may be briefly summarised as follows:—

	1907-8.	1906-7.
Share capital	£2,500,000	£2,500,000
Obligations	2,065,000	1,385,000
Gross profits	295,910	266,511
Administrative expenses ...	13,238	13,263
Depreciation provision... ...	1,173	1,208
Net profits	193,329	194,121
Reserve fund allocation ...	6,671	7,291
Dividend...	125,000	125,000
,, per cent.	5	5

The amount carried forward is £60,320, as compared with £59,900 in 1906-7. After giving particulars of the financial results of the undertakings in which shares are owned, the report refers to those under the company's own management. The development of the enterprise was threatened by the proposed electricity tax, and the assumption that the latter could be transferred to consumers, was

only partly true; whilst the taxation for power purposes epecially was a mistake. It was to be feared that the scheme, so long as the other form of energy—steam—was untaxed, would hamper the introduction of electrical driving in industrial works. At the annual meeting it was stated that the profit share in the Siemens-Schuckert works would increase by 1 per cent. in the current year, and would thereby attain the maximum. It was intended in future to participate more actively than hitherto in new transactions if they had favourable prospects, especially in connection with the various electrical projects in Bavaria.

The Rheydt Cable Works Co., of Rheydt, which was able to distribute 15 per cent. in each of the three preceding years, has been unable to pay any dividend for the year 1907-8. The gross profits on manufacturing amounted to £47,549, as contrasted with £82,031 in 1906-7, the reduction being attributed to the delay in the starting of the copper and bronze rolling mill in consequence of the failure of the municipal station to furnish supply at the appropriate time, and owing to the considerable decline in the price of copper and the depreciation of stocks. After meeting working expenses and interest charges and writing off £13,704 for depreciation, as compared with £13,778 in 1906-7, the accounts show net profits of £191 as against £29,532 in the previous year, on an ordinary share capital of £187,500.

PROCEEDINGS OF INSTITUTIONS.

The Electric Discharge and the Production of Nitric Acid.

By William Cramp (Member) and Bertram Hoyle (Student).

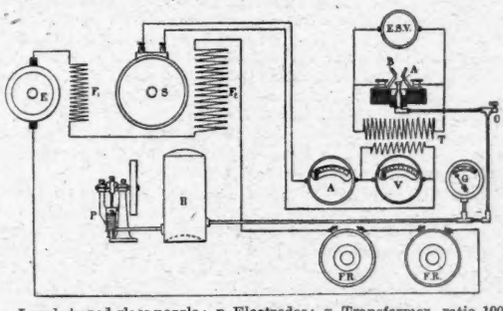
(*Abstract of paper read before the* Institution of Electrical Engineers *at Manchester, December 15th, and London, December 17th*, 1908.)

It has been calculated that the amount of fertiliser in the form of natural nitrates still available is less than that required for the world's food supply for the next 20 years—that is, assuming that no new sources are discovered. It is this fact which has brought into such prominence the necessity of obtaining a fresh supply of nitrogen compounds, and has consequently led to the erection of large plants for fixing the nitrogen of the air.

In spite of the many attempts which have been made to fix atmospheric nitrogen, little pioneer work in the way of research has been done to assist the inventor to obtain the best yield from any form of apparatus, and it is with the object of clearing the ground a little in this direction that the work embodied in this paper has been carried out.

Most inventors have attempted to fix the nitrogen of the air by the use of very high temperatures—that is, by really attempting to burn the nitrogen in the presence of oxygen to NO and NO_2, usually by means of the electric arc. In some cases, instead of burning the gases direct, union has been obtained by means of a third substance, such as calcium carbide.

Each succeeding designer has decided upon some point in the form of the discharge to be used, which he believed to be the most important factor in determining the production of the gas. Thus



A, Laval-shaped glass nozzle; B, Electrodes; T, Transformer, ratio 100 to 1; E. S. V., Electrostatic voltmeter; A and V, Low-tension ammeter and voltmeter; G, Air-pressure gauge; O_1, Air outlet; F, Air pump; R, Air receiver; F. R., Field rheostats; F_1, F_2, Exciter and alternator field coils E, Exciter; S, Stator of alternator.

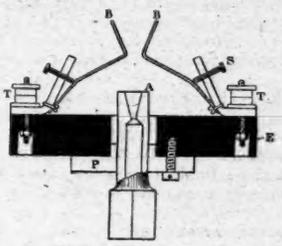
Fig. 1.

one believes that it is most essential to get the current of air into very intimate relationship with the flame (Naville and Guye). Another considers that the essential condition is to have no continuous flame, but a very large number of arcs (Kowalski and Moscicki). A third thinks that not only is a large number of arcs necessary, but that these should be also very long and very thin (Bradley and Lovejoy). Others attempt to combine these results with effects of very high temperature of the gas followed by very sudden cooling; and, again, some believe in the effectiveness of temperature gradient alone, whether the arc be large or small.

The Frank and Caro process consists in the forming first, in an electrical furnace, of calcium carbide, and then passing nitrogen over this material when at a red heat, the result being that the nitrogen combines with the calcium carbide forming cyanamide. It is essential for this process that the nitrogen should be free from oxygen, and this is obtained by fractional distillation of the air (Linde) in the manner now used for producing oxygen. It will be seen from this that oxygen is given off as a valuable by-product.

In all the processes except that of Frank and Caro, the object is to produce $NO_2 + NO$, which, when combined with water, gives a mixture of nitric and nitrous acids. From these is then usually produced nitrate of calcium, which is the fertiliser sold. In the last process the cyanamide is sold direct, and decomposes slowly in the presence of water, giving off ammonia, which is absorbed by the soil or taken up by the plants. It is worthy of remark that this substance assists the production of nitrifying micro-organisms, which themselves are germinated in large quantities and sold for use as active fertilisers.

At present Frank and Caro's process appears to yield the best result per horse-power expended, and from the point of view of cost is certainly better than Chile saltpetre already. This being the case, it is necessary to take steps to find out whether direct



A, Aluminium Laval nozzle; B, Phosphor bronze sparking ribbon; P, Aluminium plate, carrying ebonite base E and adjustab on A T, Terminals; S, Screw adjustment for gap-length.

Fig. 2.

combination in the electric arc can ever be as successful as indirect combination; and in order to do this, it is necessary to discover upon what factors the production of NO and NO_2 depend.

TABLE I.—Outputs of Nitric Acid obtained by Various Experimenters.

Experimenter.	Size of plant. Kilowatts.	Output per kilowatt-year. Kilogrammes.
Birkeland	7 to 10	400·0
	200	900·0
Lord Rayleigh	1 (theoretical)	(440 0)
*Moscicki	75	412·0
Bradley and Lovejoy ...	—	571·0

* These inventors have also used direct-current at 1,500 volts, giving 525 kg. per kilowatt-year.

The best results have always been obtained with very large powers, and the difference in the yield between Birkeland's 10-kw. and his 200-kw. plant is amazing.

The excellent result obtained by Bradley and Lovejoy from their multitude of small long direct-current arcs is to some extent verified by Moscicki's yield obtained by the use of very high-frequency discharges. It is notable also that whether the plant is large or small, the yield is poor if an ordinary hot and thick arc is employed. An arc is never successful unless made use of to heat a very large quantity of air.

It seemed safe to assume that good results are only to be obtained by the use of thin flames with very rapidly moving arc-threads, used to heat suddenly quantities of air, which are as quickly as possible cooled again. For this reason the apparatus selected for experimental results was a modification of that suggested by Werner. The plant consisted of a high-tension transformer excited by means of an alternator and used to feed on its high-tension side, a pair of phosphor-bronze ribbon electrodes shaped almost like the well-known horn lightning arresters. The nozzle A, figs. 1 and 2, was supplied with air from an air-pump and receiver, so that the air had time to cool after being compressed before issuing from the nozzle.

The air-pump was capable of giving about 4 cb. ft. of air per minute at a pressure of 10 lb. per sq. in.

The alternator was a "Cramp self-excited" machine with a very drooping characteristic, which is very suitable for giving a steady continuous discharge through the air-blast. The field was controlled by large resistances, allowing very wide regulation. The speed of the machine was 1,200 revolutions per minute, and the frequency 160. Ammeters and voltmeters were regularly employed on the low-tension and high-tension sides of the transformer. A choking coil and series resistance were used sometimes on the low-tension side. The transformer had a ratio of transformation of 100 to 1.

The details of the sparking electrodes will be seen from fig. 2.

Mr. Werner's object in using this type of discharge was to obtain a quickly expanding blast of air, for he believed that the natural cooling produced by the quickly expanding gas would of itself materially assist in the production of the desired peroxide. It was decided that a nozzle like that known as the "Laval" would be best as a general type, and various sizes of these were made in glass and were measured and tested.

The shape of flame approximated closely to a section taken between two radii, about 60° apart, of the Birkeland disk flame. The air velocity through this section being variable, admits of a very wide range of experiments both as to air quantity and conse

quent flame temperatures. Guides at the sides of the electrodes enabled the path of the air to be practically confined to the active area of the discharge, and this alone was found to make a considerable difference in the amount of acid produced.

In a previous paper it was pointed out that all types of electrical discharge have usually been divided into three classes. It is necessary now to divide the forms of electrical discharge into five classes instead of three.

By gradual increase of the current supplied to the low-tension side of a transformer, a spark between points on the high-tension side can be caused to pass through every form successively in the order—glow, brush, oscillatory spark, nitrogen flame and flaming arc. A curve for a discharge regulated in this way is shown in fig. 3, where, with gradual increase of pressure across a pair of points, a glow is formed between the limits A and B. At B a brush discharge is set up, which gradually passes between B and C into the oscillatory discharge or spark. At C the latter breaks down into the high-tension arc or nitrogen flame, which continues to exist with great fall of pressure to the point D, after which the discharge is of the character of the ordinary low-tension arc.

These characteristics and curves are correct so long as measurements are made on the low-tension side of the transformer; but if the readings of pressure and current be taken on the high-tension side, it is found that the transformer itself has considerable influence on the form of discharge. In order to test this, readings were taken using the 30-KW., 100,000-volt core-type transformer of the Municipal School of Technology. One series of results obtained is plotted in fig. 5, where the letters used agree with those in fig. 3.

The great difference between figs. 3 and 5 lies in the fact that the line B C is so much longer and so much more horizontal, and that C D has a negative slope in fig. 5.

The meaning of this is as follows:—

1. With such a transformer it is easy to make the silent discharge pass gradually and almost imperceptibly into the brush and then into the oscillating discharge.

2. With such a transformer, the capacity in circuit is always sufficient to maintain the oscillating discharge, and consequently also the pressure of the circuit, over a wide range of currents.

3. Directly the last trace of resonance ceases to exist, the discharge breaks down into the ordinary arc, but so great is the difference between these conditions and those previously existing, that the pressure falls 14,000 volts (= 80 %), and the current is reduced to less than a quarter of its original value.

4. This great change is so swift that it is impossible to trace the precise moment at which it takes place, and, of course, as the line C D_1 slopes with respect to the X axis at an angle considerably less than 90°, it is absolutely impossible by any resistance or reactance inserted, to obtain intermediate readings. Thus in such a case it can hardly be said that the discharge is continuous throughout its full length. It has been noticed that the part between C and B is so sensitive that even the change of putting on a different electrostatic voltmeter was quite sufficient to modify the curve considerably.

As has been said, these tests were all taken with a large constant potential alternator, and the readings of volts and amperes were made direct on the high-tension side. It is doubtful whether we could have found this break by taking the reading from the low-tension side (compare fig. 4).

The wave-form of the alternator was nearly sinusoidal, and every effort was made to try to get the curve complete. These efforts, however, only resulted in obtaining the cyclic curve in fig. 5. The readings were taken from O upwards to the point B, and then the pressure was increased, and the steadying resistance on the low-tension side was cut out till the curve was complete to the point D. Afterwards the resistance was put gradually in again and the pressure adjusted accordingly, so that the curve returned as the arrows show. It is easy to see from these curves why each form of discharge has often been considered to be separate from the others.

The chemical characteristics of the five forms are fairly clearly marked. Forms 1 and 2 include the glow and the brush discharge; they produce mainly ozone. Form 3, the disruptive or spark discharge, also produces a large proportion of ozone, with a sensible proportion of oxides of nitrogen. Form 4 is an arcing flame made up of arc-threads, carried into this shape by the action of the heated air to which it gives rise; its temperature is far greater than either 2 or 3, and it is composed mainly of burning nitrogen, as is evident from the fact that a bottle inverted over the flame collects the well-known brown fumes of NO_2. There is no smell of ozone with this discharge. Form 5 is the well-known low-tension alternating-current arc; it differs from 4 in the fact that the conducting part is mainly composed of the vapours of the material of which the terminals are made.

From these curves the conditions which are necessary for any particular type of discharge can be roughly deduced.

Both the air-current in our apparatus and the magnetic field in that of Birkeland will have the same effect, so far as the form of the discharge is concerned, for they will tend to cause any small arc set up to travel rapidly at right angles to the field or along the line of the air stream. Consequently, the instant an arc is formed it travels away from the point of formation, under the influence of the air stream or the field, getting longer as it proceeds, and probably smaller in cross-section. This continues until it becomes of a length such as the terminal pressure will no longer support, when it is suddenly extinguished, and another starts from the points.

Across the points themselves, with this form of discharge, there always exists the blue line of the oscillating spark, which continually renews the arc thread. We have never seen a nitrogen flame without this blue oscillating discharge.

When the current is very low the secondary discharge consists simply of bluish sparks slightly bent to the air current.

The gas given off with such arrangements is mainly *ozone*, and as the air pressure is raised the output of ozone increases, and the resulting gas comes off cooler. This discharge gives a marked oxygen spectrum.

At a higher current (8 amperes or 10 amperes in our primary), the discharge at low air pressures consists mainly of a purple flame, in which a few bluish sparks take place. The addition of the voltmeter makes the flame richer in colour and the number and thickness of the sparks is increased. As the current of air is raised the flame gets smaller in size, the high-frequency current increases, and the voltage goes up. The gas given off never changed to ozone at the highest pressure we could use, the current being too large for this.

At the full-load current for our apparatus (namely, 20 amperes), the discharge is very hot and more of the character of a low-tension alternating-current arc; under these conditions the oscillatory frequency is very low, and the nitrous gases given off are rather weak. As the pressure of the air blast is raised from these conditions, the output of nitrous gas goes up; the colour of the flame changes to a deeper and richer purple; and the temperature of the issuing gases goes down, whilst the oscillatory frequency and voltage steadily rise. The addition of the voltmeter raises the output, and this also gives a clearer and deeper coloured nitrogen flame.

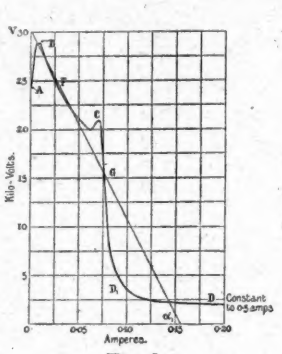


FIG. 3.

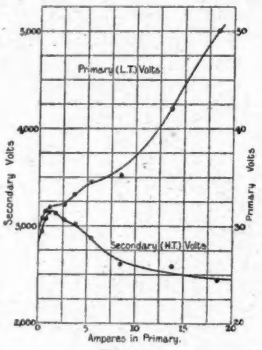


FIG. 4.

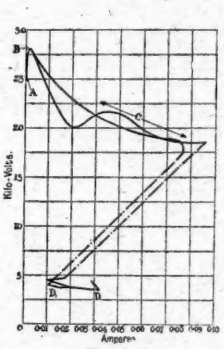


FIG. 5.

At high air pressures, the flame becomes very stable looking and fierce. The addition of a capacity at each stage of the discharge makes these characteristics much more prominent, the effect at any given current and air pressure, being, in fact, similar to an increase in the blast pressure in its effect.

To begin with, nine nozzles were tried, with the following results:—

1. The greater the amount of air passed by the jet for a given pressure, the greater is the maximum acid output.

2. The greater the amount of air passed by any given jet, the less is the maximum acid concentration.

From these two it follows that with increased quantity of air the amount of acid produced increases faster than the concentration diminishes, and therefore for a large yield per KW.-year with such an apparatus, a nozzle giving low concentration will probably be necessary.

With constant nozzle and constant air-gap, increase of current is accompanied by an increased yield.

With varying length of air-gap:—

1. Increase of current gives an increased yield up to a certain maximum for each length of gap.

2. The greater the quantity of air passed through the gap, the higher is this maximum for each gap.

There is a maximum yield for each current corresponding to a given gap length, and though this maximum for each gap length is higher, the greater the current, yet to obtain the best results the gap length must be accommodated to the current to be used.

Our impression is that under any circumstances a high-frequency discharge is present, and that this materially affects the acid yield.

Knowing the capacity and current in the surging circuit and the voltage acting, the frequency of the oscillations can be calculated. It is found:—

1. That the higher the blast pressure, the more pronounced is resonance at certain currents.

2. That the higher the blast pressure, the higher is the value of the current at which oscillations are set up, and the more prominent they are. This result has special interest in view of the fact that greater pressures have been shown to give greater acid yields.

The yield of ozone by the oscillatory discharge has been shown to increase with the frequency used, and as we consider that the presence of ozone has no small effect in the formation of peroxide of nitrogen from the flame, we think that from this cause alone the effect of high frequency would be sufficient to increase the yield.

In the first place, the current across the gap is increased by the

presence of such a shunt capacity current; secondly, ozone is given off in the lower portion of the discharge; and since this is more active than ordinary oxygen, it is reasonable to suppose that more nitrogen will combine than before to form nitrous products.

In confirmation of the above explanation of the increased output due to the ozonised air coming from the high-frequency portion of the discharge, it may be stated that we have tried an experiment as follows:—

The air supply was passed through an ozoniser on its way to a spark chamber which contained the nitrogen flame. When the ozoniser was working, the output of NO_2 from the flame was found to be increased by 20 to 100 per cent., depending on the current, air-blast, &c.

From the results of tests taken with cooling devices through which the gases had to pass on their way to the acid-testing apparatus, we conclude that the temperature of the issuing gases (viz., 125° C.) is quite high enough to cause considerable dissociation. If the gases be fairly suddenly cooled to about 24° C. after leaving the dome of the apparatus, an increased yield may be obtained, ranging from 10 to 25 per cent.

Experiments with a Tesla coil connected to metal plates between which the gases have to pass on their way to the testing apparatus, show that an increased output may be expected of from 5 to 20 per cent. in our case, depending upon the conditions existing. The fact that ionised molecules of oxygen and nitrogen pass through an electrostatic field means that some of the uncombined elements may be forced together with such a velocity that chemical combination takes place between them. In this way an additional amount of peroxide is formed.

The whole of the electrochemical phenomena herein discussed may be explained on recognised ionisation and electrochemical hypotheses, but a considerable amount of work still remains to be done before the exact output limit or proper arc efficiency can be stated.

The thermo-chemists think that the action whereby the peroxide is produced is neither a purely electric nor a chemical phenomenon, but only a thermal action. Their view is that at all temperatures a combination and dissociation of oxygen and nitrogen take place to an extent depending upon the temperature, and increasing with it.

At 3,000° C. there is, in this way, 5 per cent. of the air changed into peroxide, and unless this is cooled extremely suddenly, there will be a steady loss of peroxide as the temperature decreases, until at ordinary temperatures the percentage of peroxide present in the air is practically nil. If, however, the cooling takes place very rapidly indeed, the peroxide formed at the high temperature will not have time to dissociate, and in this way alone can a large yield of peroxide be obtained.

In connection with the production of peroxide on this hypothesis, Nernst has given a formula from which Birkeland deduces values for the peroxide produced per minute corresponding to different temperatures.

The whole series of tests that we have taken clearly lead to the belief that the equations of Nernst are applicable, and it would seem as though it were possible to apply them direct, if we only knew the temperatures existing in the flames.

We conclude that peroxide is formed in the arc by the combined agency of great temperature, great pressure, and great temperature gradient; that temperature and pressure may be interchanged, and that it is practically useless to attempt to set a limit to the maximum efficiency attainable till these relationships are better understood.

As regards practical deductions, which may be made from the tests described and plotted, we may call attention first to the great importance of adapting gap, current, and air blast to one another; for it is evident that changes of yield to the extent of 50 per cent. or more may be obtained by slight variations of either factor from the best obtainable.

Again, it may be noticed that as regards quantity of air forced through the flame, the maximum acid yield does not for a given current occur at the same point as the maximum acid strength; consequently there is reason to doubt the value of using a magnetic field (as does Birkeland) to spread out the flame. It would appear from rough estimations made on the Birkeland-Eyde process as if the efficiency of this system were such as to lead to the belief that a very good proportion of the maximum possible yield was being obtained. We feel that this is a most important point, for if this be true, then it is hardly possible to compete with the cyanamide process in point of view of cost. If, on the other hand, by making use of—

A. The most favourable velocity,
B. The most favourable gap-length,
C. The introduction of ozone,
D. The instantaneous cooling of whatever gas is produced,
E. Fixing by subsequent ionisation,

much better yields may be expected, then it is well worth while proceeding on these lines in a large plant with the object of rendering the production of NO more economical.

We may briefly mention—

1. That dissociation always is accompanied by marked ionisation which can be measured with an electroscope.

2. To such an extent is this true, that if the gas is not capable of discharging an electroscope fairly rapidly, it may be taken for granted that it is not dissociating to any great extent. (We have used this as a valuable test.)

3. Guiding the air carefully through the flame increases the yield very much, even to as great an extent as 15 per cent.

Reverting to the creeds of inventors, we think we are justified in saying that those processes which rely on intimate mixing of the air alone are not likely to be successful; that it is easily possible to exceed the temperature (or current) at which a given amount of air will give its maximum yield, so that it is not of any use to rely on temperature alone; that high frequency is not responsible for a greatly increased yield, apart from the presence of ozone; and finally, that the length and thinness of the arc are not of importance unless entailing large current density.

The Faraday Society.

The Influence of Cheap Electricity on Electrolytic and Electrothermal Industries.

Mr. E. A. Ashcroft, M.I.E.E., read a paper before the Faraday Society on December 21st on this important subject. Many electrochemical and electrometallurgical industries, such as the manufacture of aluminium or calcium carbide, or the electrolytic refining of copper, or the electrothermic production of steel, may be quite successfully carried out in countries like Great Britain, where sources of extremely cheap and abundant water-power are almost non-existent, for they can, under favourable conditions, be made to pay even when steam or gas engines are the prime movers employed. On the other hand, there are a few electrochemical processes whose very existence depends upon the availability of large sources of power that must be supplied at prices far below anything we are accustomed to in these realms—one may instance the electric smelting of iron, the manufacture of lime-nitrogen, or the complete treatment of complex sulphide ores—and for these to develop a healthy existence, it is imperative that the cost of energy should approach what Mr. Ashcroft calls the "low-grade limit," which he fixes at somewhere about £2 per kilowatt-year (reckoned, of course, on a 100 per cent. power factor). Such sources of power, which, at present, can only be waterfalls, are of course rare, but they do exist, even in Europe, and one of the objects Mr. Ashcroft had in mind in bringing forward his paper was to draw attention to the opportunities—unfortunately, somewhat limited by a short-sighted national policy of "anti-alienism"—now existing in Norway for the development of electrochemical industries, on account of the undeveloped water-powers still to be found there in some abundance.

It is only the most favourably placed water-powers that can yield electrical energy at the rate of £2 per kilowatt-year (equivalent to 0·055d. per Board of Trade unit), namely, those in which natural conditions enable the development of the power to be undertaken at a very low expenditure of capital; these Mr. Ashcroft calls water-powers of Class I. The number of these available in Norway is not great, and their enormous natural advantages will, to some extent, be neutralised by the high prices which will naturally be placed on the water rights by the owners. Of course, at present, no regular market value can be placed on these, but as will be seen from the comparative tables given below, a fair estimate has been placed on these royalty rights, and they can hardly be greatly increased beyond these figures for fear of "killing the goose that lays the golden eggs."

Water powers of Class II are defined as those where a high outlay on regulation or development is necessary to bring the water to the place of consumption, and to ensure an even supply all the year round. The price of energy from such falls is estimated at £5 6s. per kilowatt-year (0·15d. per B. of T. unit), but it may well happen that accessibility in some of these cases will more than compensate for the increased cost of power.

Water-powers of Class II will not be able successfully to demand royalty rights; at the worst these will be nominal only.

Table showing Relative Costs of Electricity Produced from Water (Classes I and II), Gas, Oil and Steam per kilowatt-year for continuous loads.

	Water (I). £ s. d.	Water (II). £ s. d.	Gas. £ s. d.	Oil. £ s. d.	Steam. £ s. d.
Fuel	—	—	2 8 0	4 0 0	4 2 6
Labour ...	0 6 0	0 8 0	0 8 0	0 7 0	0 11 0
Upkeep ...	0 8 0	0 13 0	0 16 0	0 16 0	0 13 0
Capital charges	0 13 0	4 2 0	3 6 0	2 1 0	3 0 0
Royalties ...	0 13 0	0 3 0	—	—	—
Total	£2 0 0	£5 6 0	£6 15 0	£7 4 0	£8 6 6

Mr. Ashcroft's figures for water powers, as they are available to-day in Norway, are based on a very thorough personal investigation, and may be taken as a very close indication of what one ought to expect in this direction, especially as there are cases (at Meraker and Notodden) where the figures have fallen (contract figures, it should be stated) as low as £1 14s. and £1 17s. 4d. respectively. His comparative figures for gas, oil and steam, however, although stated to be rough averages only, and to be dependent on the by-products obtained, are perhaps not quite fair to these prime movers, and cases were quoted in the discussion on the paper where, on a large scale, energy is certainly being produced from gas and steam much cheaper than the prices given in the above table. Whether or not these plants would satisfy Prof. B. H. Smith, whose opinion appears to be that whenever a steam plant sells electrical energy for 1d. a unit it does so at a loss, on account of an insufficient writing off for depreciation, is, perhaps, a moot point. On the other hand, Mr. W. Murray Morrison, who has likewise an extensive and first-hand knowledge of Norwegian conditions, is of opinion that Mr. Ashcroft has unduly penalised his Class II water-powers—£4 2s. in capital charges must represent the great capital expenditure of some £40 per kilowatt—and that, therefore, the amount of water-power available, at any rate for all but the most exacting electrochemical industries, is larger than what appears from the figures given by the latter. Other considerations difficult to state generally in terms of pounds, shillings

and pence, are questions of freightage and questions of labour and its troubles, which latter, to some extent, will depend on the source of the capital, for capital does—*pace* the extreme protectionists—sometimes take its labour with it when it seeks more profitable climes. Again, many metallurgical industries will in the future probably make use of a combination of electrothermic and direct combustion principles; for example, the combination of an electric refining furnace and a converter for making high-grade steel. These are further special considerations to be borne in mind before one can decide how cheap water-power must be before it can be applied to electrochemical ends.

Mr. Ashcroft finally discusses the cost of developing some typical waterfalls, including all necessaries up to the dynamo terminals. His figures for a particularly favourable 7,500-KW. fall may be summarised as follows:—

Earthworks...	...	...	...	£1	6	6 per KW.
Buildings ...	...	...	...	0	9	0 ,,
Ironworks ...	...	...	...	1	2	6 ,,
Machinery ...	...	...	...	3	10	0 ,,
Charges ...	...	...	...	1	0	0 ,,
				£7	8	0 ,,

A total of £7 8s. per kilowatt. A less favourable fall will cost £8 5s. per KW. (stated to be an average cost in Western Norway), and a third example given totals £11 2s. per KW. These figures compare very favourably with the £22 or so per KW., said to have been spent on the Niagara equipment, although it should in fairness be pointed out, as Mr. Gaster did, that Niagara has been developed for a much greater output than has at present been drawn from it, and this unfavourably affects not only capital expenditure on development, but likewise cost of power.

There can be little doubt that Norway's natural advantages will cause her to become a very important centre of electrochemical industry. It is urged that anti-foreign legislation is at present a bar to progress, but force of circumstances alone is bound in time to bring about a more enlightened policy on the part of the people and rulers of Norway, and they will be compelled before long to look outside their own country for the capital needed to utilise to the best its wonderful potentialities. It is to be hoped that British skill, enterprise and capital will realise before it is too late the possibilities of our obtaining a fair share of what is very likely to develop into a very great source of industrial wealth.

The Röntgen Society.

The special work in connection with the setting-up of a standard of radio-activity, upon which the Röntgen Society has been engaged for the last two years, was carried a stage further at the last meeting of that body on January 7th. The report of the Standards' Committee a year ago recommended that the gamma-ray ionisation from 1 milligramme of pure radium should be regarded as a standard, and called a unit of radio-activity. The Council thereupon deputed the task of sealing up some small quantities of radium to Mr. C. E. S. Phillips, F.R.S.E., with the idea that these should be used as sub-standards.

At the recent meeting Mr. Phillips read a paper on the subject of his work, and formally presented to the Society three sub-standards, containing between them about ·5 mg. of Rd Br_2. Mr. Phillips said that, in order to handle the small amount of salt with greater facility, a quantity of powdered silica was coated with it. Approximately 1 milligramme of radium bromide was obtained and tested against a nearly pure specimen of known weight. The salt was then dissolved in water, and a small quantity of prepared silica was added. On evaporating the liquid, the dry powder remaining consisted of silica particles coated with a layer of Rd Br_2. After well mixing, this was set aside and bottled, and the process was repeated until scarcely any radio-activity could be detected from the inside of the original vessel. The various quantities of silica so treated were finally mixed together and sealed into a glass bulb. A carefully-selected length of soda-glass capillary tubing was selected, a small bulb blown out at one end, and a spiral of thin platinum wire introduced to carry off any positive electrification which might accumulate upon the inner surface of the glass. A small quantity of the radium-coated silica was dropped through a funnel into the bulb, and the tube was then exhausted and sealed off at the fine neck. After being subjected to prolonged annealing the little bulbs were fitted into a suitable case and were ready for any of the purposes to which a standard might be put.

In the course of the discussion, Mr. F. H. Glew pointed out that Sir William Ramsay had recently made some experiments which tended to show that radium after a time appeared to lose its power to decompose water, and he (Mr. Glew) suggested that it would be well to have a standard of oxide of uranium kept just as jealously, and under the same conditions, as these radium standards. If, as might turn out to be the case, radium lost some of its properties more quickly than theory had predicted, there would at least be standards side by side with it, with which comparisons could be made.

Mr. Phillips said that several radio-active standards had already been set up. There was one at Vienna, and another in America. He agreed that they ought all to be brought into line. In reply to other questions, he said that before definitely weighing the radium in these sub-standards he would wait until they had reached a radio-active equilibrium—in about three months—when they would be compared with the known weight of radium at Victoria University, Manchester. The Röntgen Society hopes that these sub-standards will be a means of minimising fraud in the sale of expensive radium preparations.

BUSINESS NOTES.

Consular Notes.—Chile.—The Austrian Consul at Valparaiso reports that in the year 1907 there were open to the public in Chile 323 telegraph stations belonging to the State system; the total length of line was 13,500 kilometres. The lines from Iquique to Zapiga and from Obra to Santiago were newly laid. The Chilian Government Telegraph Department have arranged with the Governments of Brazil and Argentina for a reduction in the tariff for the dispatch of cable messages destined for Europe. This tariff will be about 50 per cent. cheaper than those of the private cable companies. However, a cable telegram sent by the Government lines requires from six hours to eight hours longer in dispatch, than those sent by the private cable companies, so that in general one would prefer still to use the private lines for over-sea dispatches in spite of the increased cost.

France.—The Austrian Consul at Marseilles reports that the development of industry in that department is amply shown by the increase in the number of steam engines in use, which increased from 1,730 in 1906 to 2,023 in 1907. In addition to these steam engines, there are in use 509 gas engines, producing 1,404 H.P. This is a decrease as compared with the previous year, when there were in use 640 gas engines, producing 3,297 H.P. This decrease is due to the fact that a number of the gas engines in use have been replaced by electric motors. The production of electric energy by steam power increased from 2,649 H.P. in 1906, to 17,032 H.P. in 1907. To this must be added 8,250 H.P. for the tramways in Marseilles, and 500 H.P. for the Marseilles-Aix tramway. The town of Marseilles has up to the present been supplied with electric current by two competing companies, the Société du Gaz et de l'Electricité and the Compagnie d'Electricité de Marseille, with works at Areno and Cape Pinede, where coal is easily obtainable and electric energy cheaply produced by means of steam motors and turbo-alternators. Both companies have erected systems in the centre of the town for continuous current and on the boundary for alternating current. The installations of these companies were in the form of experiments, and are only intended for small power supplies. The Société d'Energie Electrique du Littoral Mediterranean, whose district covers four departments: Alpes Maritimes, Gard, Var and Bouches du Rhone, has installed hydro-electric works at Brillianne-Villeneuve to utilise water from a fall in the river Durance of 25 m. height, producing a force of over 10,000 H.P. under a tension of 30,000 to 50,000 volts over a distance of 100 kiloms. to Marseilles. This current is transformed at the Allanch works, 10 kiloms. from Marseilles, and is supplied to the Tramway Co., the Société du Gaz et d'Electricité and various other industial undertakings. The time seems to be not far distant when the smoke plague will be unknown at Marseilles.

Later in his report the Consul states that the tramway system of the town and district, which is carried on by the Cie. Generale Francaise de Tramways, a company with a capital of 50,000,000 fr., with headquarters in Paris, had in the year 1907 a total length of 138 km., an increase of 17 km. Since the year 1900, when the line had a total length of 72·4 km., the length of the system has almost doubled. The total number of kilometres covered in 1900 amounted to 9,500,000, but in 1907 the number had increased to 19,500,000. The number of passengers carried was 42,250,000 in 1900 and 87,000,000 in 1907. The gross income has doubled since 1900, and in 1907 it amounted to 9,000,000 fr. Formerly the energy required was obtained from one of the electrical works producing electricity by means of steam power, but since the end of 1907 energy is also obtained from the Compagnie Energie Electrique du Littoral Mediterranean.

Russia.—The Austrian Consul at Kieff, in a recent report, states that no great change was shown in the machinery industry of that town during the past year. The machinery works had little business, and results were, therefore, even more unfavourable than in 1906. Water-tube boilers are imported in fairly large quantities from Great Britain, but the greater part of the demand is supplied by Russian works, as the high rates of duty leviable have rendered importation from abroad very difficult. Boilers of other kinds are hardly ever imported from abroad. Armatures are imported chiefly from Austria, and to a lesser extent from Germany.

Turkey.—The Austrian Consul at Constantinople reports that increasing business is to be found in Turkey in electrical goods. Electricity has up to the present been almost confined to the houses and palaces of the rich, but numbers of concessions have recently been granted for installation work of all kinds, and it is anticipated that the trade will increase from year to year.

Italy.—The German Consul at Naples reports that the German trade with that district in electrical goods is continually increasing. Other countries sharing the trade, but in a smaller degree, are Switzerland and Austria. The steam engines and boilers in use in the south of Italy are for the most part constructed in the north, and imports from abroad have been almost suspended. Certain engines are, however, imported from Great Britain and Switzerland, and semi-portable locomobiles from Germany. The use of steam engines and locomobiles has suffered by the adoption of suction gas motors for industrial purposes, owing to the greater economy in their working, particularly for the small industries which mostly exist in the district. Suction gas plant is produced by certain

important firms in Italy, but supplies also come from Great Britain Germany and Switzerland. Electrical machines are for the most part imported from Germany, but the Italian industry is vastly extending. Petroleum and benzine motors are imported from United States, Great Britain and Germany, but only in limited quantities as yet; the demand is, however, increasing owing to the reduction of duty on petroleum. Steam pumps are imported from Great Britain and Germany, and millwork from Switzerland, Germany and Hungary. Their manufacture is, however, on the increase in Italy. Machine tools came from Germany and from United States in smaller quantities, whilst the demand from the United Kingdom is decreasing.

Calendars and Catalogues, &c.—The Reason Manufacturing Co., Ltd., of Lewes Road, Brighton, have sent us a paper weight, which we shall find very effective in keeping down our correspondence for some time to come. In design it is pleasing, and is quite out of the ordinary run; it consists of a figure bearing in her hand an electric lamp, the rays from which strike a reflector standing behind, the whole being executed in metal and fixed upon a substantial base. The lady will excuse us if we occasionally cast our ashes at her feet.

Mr. G. Braulik, 8, Lambeth Hill, London, E.C.—New pamphlet describing, and stating prices of, several new types of incandescent glow lamp testers.

The Brush Electrical Engineering Co, Ltd., of Loughborough.—We have received an artistic hanging calendar, an effective pictorial representation of life "In the Foundry," reproduced from a painting by E. R. Fox, appearing above a block of daily slips for the year 1909, each slip giving a quotation from some celebrated author.

Messrs. Cryselco, Ltd., Kempston Works, Bedford.—Leaflet giving prices of metal and carbon-filament lamps.

The Armorduct Manufacturing Co, Ltd., of Farringdon Avenue, E.C., have sent us a pocket of 1909 refills for the useful perpetual desk calendar which they issued a couple of years ago.

Messrs. Richard Wade, Sons & Co., Ltd., Hull.—Twelve-page pamphlet containing illustrated particulars of wooden masts supplied by them for wireless telegraphy, also wooden troughing for cable-laying.

Messrs. Stewarts & Lloyds, Ltd, Nile Street, Birmingham.—Small pocket catalogue of 92 pages, wherein are given many particulars in tabulated form, of dimensions and weights, &c., of various gas and steam and other tubes, bends and fittings, patent loose flange joints, tube coils, feed-water heater coils, together with many neat illustrations.

Messrs. O. C. Hawkes, Ltd, Birmingham and London.—New catalogue (No. 25A) containing, in the course of some 40 pages, particulars of their now well-known "X L" patent induced draught system of electric heating, together with illustrations of a large number of artistic designs in different styles, including their latest productions, of convectors and radiators. These range from a modest 35s. plain stove for use in garages to others, such as "Delacroix" ornamental French stoves at many times the price for the Ritz hotel, and some still costlier lines. Some cheap lines of four-lamp radiators are also introduced in this catalogue.

The "Acme" Meter Co., 46, Queen Victoria Street, E.C.—Several illustrated and priced leaflets relating to the "Acme" combined time meters for tramcars, also a reprint of an article from the Electrical Review on "Bonus Systems Based on the Use of Meters on Tramcars."

The Phœnix Dynamo Manufacturing Co., Ltd., of Thornbury Works, Bradford, has in circulation a well-designed large hanging calendar, the upper portion including plainly printed monthly date-sheets, and the lower giving a number of half-tone views of electric generating machinery, motors, motor-driven pumps and other Phœnix manufactures of the same classes. Covered by the date-slips is a table giving sizes, weights, resistances, &c., of copper.

Messrs. J. L. Cateaux & Co., 10, Bush Lane, E.C.—Price list of "Fulmen" auto-transformers for use with metallic-filament lamps, of British manufacture, and ranging in size from 0·05 to 4·0 kw., with very high efficiency.

The International Time Recording Co., 151-155, City Road, E.C.—Sixteen-page pamphlet relating to the International Bundy and Rochester card system of automatic time-keeping and job-costing. Illustrations of the various recorders are given, also prints of reduced facsimile cards.

The Foster Arc Lamp and Engineering Co., Ltd., Wimbledon.—January list giving prices in tabulated form of the Foster patent transformers for various voltages and periodicities, and showing diagrams of methods of connecting up. Standard sizes are held in stock.

Messrs. J. & H. Grevener, Eldon Street House, E.C.—New list (No. A 3) giving in the course of some twelve pages illustrated particulars and prices of various arc lamp accessories, couplings, winches, pulleys, flexible steel rope, &c.

The Western Electric Co., of Norfolk House, Victoria Embankment, and North Woolwich, have issued a neat wall or desk card whereon appears in small type a calendar for the year as well as a packet of cards for changing daily.

The British Insulated and Helsby Cables, Ltd., Prescot.—Catalogue (L 32) giving in some 32 pages capital illustrations, together with prices, and a few descriptive notes, of various telephone apparatus for common battery, magneto and primary battery working, also telephone cords, trembling bells, switches and detectors. A view of the Cardiff (Post Office) trunk exchange is given.

Messrs. Marples, Leach & Co., Ltd., Adnil Building, Artillery Lane, E.C.—Two illustrated price lists; No. 204 E, which is a revised edition of the firm's list of polyphase motors, in the course of 40 pages describes, and tabulates in detail in excellent style with prices in red, their single, two and three-phase induction motors; No. 304 E list consists of some 36 pages of well illustrated and neatly arranged matter relating to the firm's direct-current crane and lift equipments, motors, switches and controllers, brake lifting magnets, limit switches, switchboards, &c. Both lists contain full dimensional data and diagrams. A further list (No. M 1) gives prices and particulars of "Adnil" small motors, sewing machine motors, polishing and buffing machines, and electrical drills, of which they have a stock in their showrooms.

Sentence.—At Chester Quarter Sessions on January 5th, Thomas Mitchell, of Dukinfield, who was recently committed for trial on a charge of attempting to obtain £20 by false pretences from Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester, by representing that he was authorised to obtain tenders for cables for the Central Uruguay Railway Co., Monte Video, was convicted and sentenced to six months hard labour.

Harton Collieries Supply.—In our article on "Some Siemens Installations of 1908," which appeared last week, we stated that the Harton Coal Co. obtained electrical energy from the Cleveland and Durham Electric Power Supply Co. This, we are informed, is incorrect, as from the commencement the County of Durham Electrical Power Distribution Co., Ltd., has been, and now is, providing the entire supply to the Harton Co.

Liquidation.—H. & T. Danks, Ltd.—A meeting is to be held at the Crown Boiler Works, Netherton, on February 18th, to hear an account of the winding up from the liquidator, Mr. A. E. Percy.

Wind-Power Plants.—With reference to the article on p. 78 of our last issue, describing a German wind-power plant, a firm in the London suburbs has lighted its works by means of such a plant, and is manufacturing similar equipments in various sizes for private house lighting, running electric lifts, or other purposes for which electric power is required. We hope to publish details in an early issue.

Safety Hand Lamps.—The fatal accident at Lot's Road generating station, due to a hand lamp which, said Mr. G. S. Ram, was "not better and not worse" than the majority of such lamps, recalls attention to the dangers which Mr. Ram has pointed out in connection with the use of portable lamps. In our abstract of his last report, we illustrated a design which was free from the defects in question. This was at once adopted by manufacturers, notably by the General Electric Co., Ltd., who make a device wholly of insulating material, and therefore perfectly safe. We have also illustrated a safety hand lamp made by the British Insulated and Helsby Cables, Ltd., in accordance with Mr. Ram's recommendations.

Trade Announcements. — Messrs. H. Newton Knights & Co., of 19, St. Dunstan's Hill, Great Tower Street, E.C., have been appointed sole agents for the London district and the South of England for the Northamptonshire Direct Castings Co., Ltd., and Messrs. Thomas Butlin & Co., Ltd., of Wellingborough, for the sale of their castings and pig-iron.

Messrs. Marples, Leach & Co., Ltd., have appointed Mr. W. M. Davidson their branch manager for Scotland. Their office is situated at Baltic Chambers, 50, Wellington Street, Glasgow, where samples of their various manufactures and special lines may be inspected. The company report a steady increase of business.

LIGHTING and POWER NOTES.

Aberdeen.—A controversy has arisen in Aberdeen over a proposal that the electrical engineer be authorised to procure a stock of heating and cooking apparatus for hiring out, the contention being that such a step is unfair to the private traders. It was pointed out that the Electrical Committee was holding an electrical exhibition for the purpose of showing the useful purposes to which electricity might be put, and it desired to be in a position to hire out apparatus, because it believed that none of the private firms in the city were prepared to undertake such work. After much discussion, the T.C. agreed to delay the matter for three months.

Ainsdale.—The Birkdale District Electric Supply Co. has informed the Council that the question of supplying energy in Ainsdale is receiving the attention of the directors.

Bacup.—The local council has decided to obtain a bulk supply of electricity from the Rawtenstall Corporation, instead of from the Lancashire Electric Power Co.

Bath.—The sub-committee dealing with the proposed purchase of the electrical undertaking is considering the position of the Corporation in regard to the City of Bath Electric Supply and Somerset and District Electric Power Bills deposited for Mr. Schenk, with a view to taking such steps as may be necessary to protect the Corporation's interests.

Belfast.—At the weekly meeting of the Electrical Committee, a deputation attended from the Belfast B. of G. relative to the electric lighting of the Abbey Sanatorium, Whiteabbey. The deputation wished to know if the Corporation would put down the mains and supply electricity, or if the Guardians were to put down the cable. It was pointed out that the loss in transmission would be so excessive as to make the cost prohibitive, but eventually it was intimated that if the Board desired to go on with the matter the Corporation would give every facility. The distance is about seven miles from the power station in the city.

Berkhampstead (Herts.).—At a special meeting of the Council, it was resolved to consent to the granting of an order asked for by the Chesham Electric Lighting Power Co. for powers in the district. Correspondence was read from the company agreeing that if the public lamps were lighted every night for a reasonable number of hours, it would be willing to accept a fixed price of £4 per annum for each 50-C.P. lamp. The charges for lamps of higher power would be based on the maximum charge named in the schedule, viz, 3d. per unit for public lighting. The Council is to have power to purchase the undertaking in its own area, without any advance for compulsory purchase, after 10 years, provided it takes a supply of current in bulk from the company, on terms to be agreed upon, or failing an agreement, by arbitration. At the end of 30 years the Council can purchase on goodwill terms without any hampering clauses.

Bradford.—On Tuesday last week, the Electricity Committee considered the report of its electrical engineer, recommending the installation of two 3,000-KW. A.C. turbo-generators at the Valley Road station. The estimated cost of these, together with other necessary work, was £50,000. The report was approved and adopted; and it was decided to inspect the various turbine plants of the tenderers before accepting any tender.

Canada.—ONTARIO.—By the agreement with the Hydro-Electric Power Commission, the city of Toronto expects to have the power delivered in the city by December 19th next. At that time the transmission line to the Falls will be completed. It is expected that 17 more municipalities in Western Ontario will arrange to take power from the Hydro-Electric Commission. Many of these municipalities are, however, now using natural gas, and the electric power which they will take must be cheap indeed.

Chesham Bois.—The Chesham E.L. Co. is applying for a prov. order for electric light at Chesham Bois, and intends, if the demand justifies the expenditure, to extend the mains to Amersham.

Chile.—The hydro-electric installation which the Electric Traction and Lighting Co., of La Florida, utilising the waters of the Canal de San Carlos, is erecting, is planned in its first stage for a power production equal to 16,000 H.P., but in its final stage will represent 22,000 H.P. From this plant electrical energy will be transmitted to the city by underground cables at 12,000 volts, and it will be transformed by the company at the three following places:—At the principal sub-station in the Calle Mapocho, which will contain seven transformer groups of 1,000 KW. each; at the Victoria sub-station, with its two groups of transformers of 1,000 KW., and two of 500-KW. each; and at the sub-station in the Calle Union Americana, with its two transformer groups of 500 KW. each. At present the normal production of power from the plant at the central station barely reaches to 4,000 KW. The above is the largest and most important work that is being done at the present moment in Chile.

Continental Note.—BELGIUM.—La Compagnie Générale pour l'Eclairage et le Chauffage par le Gaz, of Charleroi, has recently established a central electrical generating station at Cambrai, for the supply of electricity for lighting purposes to a number of villages in the district.

Epsom.—At the last meeting of the U.D.C. a resolution was passed "That the accounts and books of the electric light undertaking for the period between April 1st, 1907, and September 30th, 1908, be examined by Messrs. Jackson, Pixley & Co., and that they prepare and present a report suggesting any improvements that can be made within the limits imposed by the L.G.B. and B. of T. regulations, in the book-keeping office routine and staffing, which will tend to a more efficient and economical working of the undertaking."

Gillingham (Kent).—The T.C. has fixed the price of electricity for flash signs at 3d. per unit, the same rate as for arc lamps.

Hull.—The Electricity Department has added some 20,000 equiv. 8-C.P. lamps during the nine months ended December 31st, 1908. These include approximately 120 H.P. of hired-out motors—a result which is regarded as very satisfactory to the motor-hiring department. During the period mentioned, a sub-station to accommodate 600 H.P. of plant for the supply in East Hull; a sub-station for bulk supply to a large works in Central Hull; the renewal of old mains and the modernising of the power station plant, have occupied the attention of the Electricity Department.

Little Hulton.—Correspondence has passed between the South Lancashire Electric Power Co. and the U.D.C., in respect of the completion of the transfer of the Council's Electric Lighting Order, in which it is stated that the company has raised a large sum of money for the purpose, and is at present in close touch with the B. of T., from whom a suitable reply with regard to the transfer is expected.

London.—HACKNEY.—The Electric Lighting Committee of the B.C. has had under consideration the question as to whether in future the laying and jointing of services and distributing cables should be carried out by contract or by the works staff under the control of the borough electrical engineer. The data that has been collected show that Finchley and Stoke Newington are the only municipalities within a radius of 20 miles of London where mains are laid by contract. The Committee is in favour of purchasing cables and jointing materials by contract, and holds that extensions, trench work, cable-laying and jointing should be executed by the distributing staff. If mains extensions and service work are carried out, plant will be necessary, at a cost of about £75. The Committee recommends that from March 31st next the distributing staff execute the laying and jointing of cables and service lines; that tenders be invited for the supply of cables, troughing and jointing materials for three years; that the permanent reinstatement of the surfaces of the public footways and carriageways be carried out either by the Works Committee or by contract, whichever is cheaper to the department; and that a staff be organised and plant obtained.

STEPNEY.—In regard to the decision of the Council in October last authorising the electrical engineer to take a stand-by supply from a contiguous undertaking, it has become necessary, as the London Electric Supply Bill has since been passed into law, to obtain the approval of the B. of T. to the agreement proposed. An application is to be made accordingly.

LAMBETH.—The Council at its meeting on January 7th accepted an offer from the South London Electric Supply Corporation to light Electric Avenue, Brixton, with electricity. The Corporation is to install, at its own expense, 11 100-C.P. metallic-filament lamps, and to light them in accordance with certain conditions at a total cost to the Council of £15 15s. per annum, for five years. It was stated that the cost to the Council would be less than the cost of gas lighting would be.

STOKE NEWINGTON.—The municipal electrical plant recently put down in connection with the destructor was officially started last week by the Mayor; the cost of building and plant has been £3,700. It will be remembered that the North Metropolitan Co. is exercising bulk supply powers in this area, and the above plant will be worked in conjunction with the company.

Lyme Regis.—A special meeting of the T.C. was held last week, when it was decided to adopt an electric supply scheme through the Lyme Regis Electric Light and Power Co., who will be granted a 7 years' contract for street lighting; it is proposed to install a water-power generating plant.

Macclesfield.—At a meeting of the T.C. last week, the question of electric supply in the town was discussed at length, and ultimately an amendment, proposed by Councillor Crowe, was carried, that a special sub-committee be appointed to consider the whole question, and report to a future meeting of the Council. The town clerk was instructed to lodge formal objection to the application of a company to secure a prov. order for electric supply in the borough.

Maidstone.—With reference to the recent application of the T.C. for a loan of £20,770 for electricity purposes, the L.G.B. has informed the Corporation that before any sum can be sanctioned it will require an assurance that certain irregularities through excess expenditure will be avoided in future, and that proper and separate accounts of the expenditure under each loan will be kept. The Board also requests the T.C. shall submit proposals for paying off an overdraft on account of illegal expenditure on motors and free wiring within a shorter period than seven years.

Manchester.—The Corporation is considering a demand made upon it by the U.D.C. of Droylsden for a supply of electricity to users in its district. There is an existing agreement by which the Corporation is bound to supply energy within the urban district for lighting and power purposes. Recently the Urban Council reminded the Corporation of this agreement, but the Corporation is desirous first of ascertaining the number of probable users. Under any circumstances, the Droylsden Council says that Manchester must carry out its obligations.

Merthyr Tydfil.—The T.C. has referred to a Committee an offer from the Electric Traction Co. to light roads from Pontmorlais to Cyfarthfa Castle by electricity with 72 lamps, at £252 per annum.

Middlesbrough.—The T.C. having received from the Theatrical Managers' Association a request for a reduction in the price of current to a maximum of 3d. and a minimum of 2d. per unit instead of 4d. and 2d., has appointed the chairman of the E.L. Committee and the electrical engineer (Mr. H. M. Taylor) to interview the members of the Association.

A booster is to be installed at a cost of £225.

Preston.—The local Trades Council unanimously passed a resolution on January 6th stating that it was of opinion that the time had arrived for the undertaking of the Electric Supply Co. to be acquired by the town.

Rotherham.—The borough engineer is to draw up a report dealing with the question of street lighting by electricity in the Blackburn portion of the district.

Rottingdean.—Brighton T.C. desiring to supply energy to a residence in the parish, has asked the Newhaven R.D.C., the local authority, for permission to do so. The R.D.C. has referred the matter to the Parish Council, and has asked Brighton for its charges for electricity.

St. Helens.—The T.C. has decided to allow the following scale of discounts to large power consumers:—Consumers with a minimum load factor of 30 per cent. consuming from 30,000 to 40,000 units per month, 30 per cent.; 40,000 to 60,000 units, 35 per cent.; 60,000 to 80,000, 32½ per cent.; 80,000 to 100,000, 40 per cent.; over 100 000, 42½ per cent., plus the usual 2½ per cent. allowed on net monthly accounts.

The T.C. has received from the L.G.B. sanction to a loan of £9,439 for electricity purposes. A further loan of £1,275 for mains extensions has been applied for.

Stockport.—The T.C. has adopted the following new scale of charges for electricity for power purposes:—First 50 units per H.P. of motor installed, per quarter, 1·25d. per unit; second 50, 1·125d.; third 50, ·875d.; fourth 50 and above, ·75d. Large consumers with continuous running motors, guaranteeing a consumption of not less than £80 per annum, are to be supplied at the following rates:—First 50,000 units per annum, ¾d. per unit; second, 50,000, ·7d. per unit; over 100,000, ·6d., with a rebate or addition of 2s. 6d. per 1,000 units for every 1s. per ton variation in the price of coal based at 10s. per ton.

Tonbridge.—The U.D.C. has entered into agreements for the supply of electricity for power and lighting with Rowland Stagg, Ltd., for five years; and with the Acme Chemical Co., Ltd., for three years.

Uruguay.—The Junta Economico-Administrativa, of Rocha, has been authorised to enter into a contract with Mr. Federico Ribas for the lighting by electricity of the town of Rocha. The contract is for a term of 20 years.—*Board of Trade Journal.*

Walmer.—The B. of T. has asked the U.D.C. if it would be prepared to give an undertaking to put the E.L. order into operation within a year, in the event of the Board deciding to defer revoking the order for that period. The Council on January 6th, decided to ask the B. of T. to allow the matter to stand over until the February meeting for inquiries to be made.

West Ham.—In regard to the adjourned L.G.B. inquiry, the details of the estimate have been revised, although the total of the application (£51,600) for the proposed loan, remains at the same figure. Agreements have been approved for the supply in bulk of energy to the Saw Mills Co., the City Glass Bottle Co., the Charing Cross Electricity Supply Corporation, and Messrs. John Knight & Sons.

Whitwood.—The B. of T. has granted the U.D.C. three months' extension of the Electric Lighting Order.

Worcester.—The Electricity Committee is recommending the Council to apply to the L.G.B. for sanction to borrow £5,752 for electricity purposes, this sum including £852 excess expenditure, &c., on previous sanctions.

TRAMWAY and RAILWAY NOTES.

Brazil.—Owing to an increase in fares and irregular tramway services, a number of cars belonging to the Light and Power Co. were recently attacked and burned in Rio de Janeiro by the populace; a fight took place with the police.

Burnley.—The Tramways Committee has given notice to the Nelson Corporation and Brierfield D.C. requiring that the rent of the tramways within their respective areas be revised after March 31st; also the terms for the supply of electric energy within the Nelson and Brierfield districts by the Nelson Corporation.

Burton-on-Trent.—The negotiations with the Midland Railway Co. for a lease to them of the tramways from the boundary of the borough to the junction of the Church Hill Street, are now practically completed. An annual rent of £825 is to be paid, together with 1·3d. for each unit supplied to the company for 21 years, with an option to the company for a further period of 21 years. Running powers are to be given over the Corporation tramways to Wellington Street for a similar term, subject to the payment of 4½d. per car-mile.

Canada.—Stray currents from the tramways are stated to be damaging the water-mains in the city of Winnipeg. A feature is that the leakage varies with the conducting material of the underlying strata. In certain sections where the ground is impregnated with carbonates the effect of the leakage of the current has been to set up chemical action, which coats the pipes and renders them passive to the effects of the current. In the portions of the city where the soil is filled with chlorine from the salt water, a distinctly increased harmful effect is noticed on the pipes. Investigations are being carried on by the city electrician.

Continental Notes.—GERMANY.—The demolition of the experimental section of the suspended electric railway in the Brunnen Strasse, according to the Berlin *Tageblatt*, will presumably take place at an early date. The municipal authorities required the Suspended Railway Co. to erect, on the route of the projected line from Gesundbrunnen to Rixdorf, a trial length, so as to afford an opportunity for the authorities and population to obtain an impression of the method of construction. A year and a half ago the section was erected in the Brunnen Strasse, which is very narrow, but it caused opposition on the part of the inhabitants, the Berlin newspaper declares, owing to the interruptions in traffic through the supporting framework, and in consequence of the interference with daylight. The municipal Highways Committee will shortly consider the question and arrive at a definite decision.

SWITZERLAND.—A concession has been accorded for the construction and working of an electric railway of standard gauge from Bienne to Anet *via* Täuffelen. Similar concessions have been granted for an electric railway from Lugano to Ponte Cremenaga, *via* Bioggio, Sorengo, Agno and Ponte Tresa; and for an electric railway covering part of the route between Chiasso and Muggio.—*Board of Trade Journal.*

Dudley.—The T.C. last week adopted resolutions authorising the promotion in Parliament of a Bill giving the Corporation power to purchase the local tramways, and to lease them to the B.E.T. Co. for 30 years, and also that the cost of the Bill be charged to the borough rate fund. Councillor H. W. Hughes explained that as soon as the Bill became law, the cost would be refunded by the company. The action of the Council was afterwards confirmed by a public meeting of ratepayers held in the Town Hall. The town clerk (Mr. Brettell) said that in consequence of the long litigation with the tramway company and the arbitration in which the Corporation had been successful, the costs had been very heavy. He also stated that it had been mutually arranged that the lease should be for 30 years, an arrangement which would be to the benefit of the present generation of ratepayers, because if it had been for only 21 years the rental would have been barely sufficient to have paid interest and principal on the tramway loan.

Eccles.—Legal proceedings have been instituted by the municipal authorities to prevent Salford from allowing tramways leased to them being used by the South Lancashire Tramways Co. Efforts have been made to prevent further litigation, but the opinion of the Eccles Corporation, arrived at at a private meeting, is that the proceedings must go forward so long as Salford refuses to make a request for the permission of Eccles to its action in relegating the use of the lines to another party.

London.—The Hammersmith B.C. has decided to oppose the L.C.C. proposal to link up the Willesden and Putney Bridge tramways, by a temporary line across Hammersmith Broadway.

The St. Pancras B.C. Works Committee recommends approval of the tramway reconstruction in King's Cross Road.

In connection with the Bow Road tramways, the "G.B." Co., in fulfilment of the recent arrangement with the Council, is putting one mile of track into a workable condition, and is providing a car with the company's standard collecting equipment, in place of that provided by the Council. It is expected that this work will be sufficiently advanced to enable the company to demonstrate the capabilities of the system in a month or so.

Milnrow.—The U.D.C. is negotiating with the Rochdale T.C. for the extension of the tramways to the town. Rochdale has offered to extend the system to Milnrow on terms similar to those recently entered into with Whitworth U.D.C.

New York (U.S.A.).—In consequence of the numerous fatalities to foot passengers crossing electric railways and tramways in America, a large reward was recently offered for an invention which would reduce such risks. According to a *Daily Telegraph* correspondent, the latest device on trial is operated by compressed air, by means of which the unlucky individual is literally blown off the track. It is comforting to learn that, although the "victims" may be considerably injured in the above operation, yet they will usually avoid death by tramcars.

Rawtenstall.—The work at the generating station at Hareholme is being pushed on with all speed. The building is now almost ready for the machinery, which has been completed. It is expected that the electric cars will be running by Easter. It has been decided to lay a temporary loop line at Crawshawbooth, so that cars can be run from the Rawtenstall station to the borough boundary. The B. of T. Inspector has given his consent to this temporary arrangement.

Rowley Regis.—It was stated in this column last week that there was a likelihood of further delay in the construction of the Cradley Heath, Quarry Bank and Brierley Hill light railway, owing to the negotiations between the promoters and authorities not having been completed. There has since been a new development. Intimation has been received from the B. of T., that unless the construction of the railway is commenced within another 12 months, it is possible the Board will be unable to grant any further extension of time. The B.E.T. Co. is, it is well known, desirous of carrying out the provisions of the Parliamentary Order, but there has been a difficulty in arranging terms. The various local authorities are agreed that it is necessary that Mr. Vesey Brown, who represents the Tramway Co., should deposit a sum of money in the hands of the joint treasurer and the authorities, rather than that any security debentures should be given; but it is evident that an amicable agreement will now have to be arrived at, and the work expedited if the benefit of the provisional order is to be realised.

South Shields.—At a meeting of the T.C. on the 6th inst., the Electrical Committee presented a report by the electrical engineer, with respect to the charges made for energy for the tramways, and recommended the Council not to entertain the application of the Corporation tramways department for a reduction of the

price charged. Alderman Rennoldson, in moving the adoption of the Committee's report, said that the Tramways Committee had made an application for a reduction in the price charged for energy to 1·235d. per unit from an average of 1·38d. per unit last year, and an estimated charge of 1·36d. this year. If the Electricity Committee granted the reduction asked for, it would practically wipe out the profit on the electricity undertaking. The report was adopted.

Torquay.—With regard to the proposed transfer of the tramways to the Torquay Tramways Co., for £157,500, the T.C. has decided to object to the transfer and to ask the B. of T. to withhold their approval until the Council is satisfied that the Corporation will not be prejudiced if at any future time the undertaking comes into the market. The Council is of opinion that the sum mentioned is in excess of the cost of the undertaking, especially as the whole of the works contemplated under the Act have not been executed, and all the obligations of the Dolter Co. fulfilled.

Tramway Statistics.—According to a B. of T. return issued on Saturday, the length of British tramways open for traffic has increased since 1878 from 270 to 2,460 miles; the capital expenditure from £4,207,350 to £68,199,900; the passengers carried from 146,000,000 to 2,626,000,000; and the net receipts from £231,000 to £4,647,000. Comparative statistics for the last two years are as follows:—

	1906-7.	1907-8.
Miles open	2,394	2,464
Cars running	11,746	12,049
Passengers carried ...	2,454,807,487	2,625,532,895
Units used	369,362,473	431,969,119
Gross receipts	£11,849,175	£12,439,625
Working expenditure ...	£7,363,762	£7,792,663
Net receipts	£4,485,413	£4,646,962
Relief of rates	£297,456	£319,676

Of the 305 undertakings, 177 belong to local authorities and 128 to companies or individuals. Local authorities which work, as well as own, their tramway undertakings made a profit of £3,286,713 on the year's traffic, out of which, in addition to setting aside £319,676 in relief of rates, they applied £916,291 towards the reduction of tramway debt, and carried £728,653 to reserve and renewal funds. In the cases of three local authorities and seven companies, the returns show an excess of working expenditure over gross receipts.

The capital expenditure and mileage were as follows:—

	Capital expenditure.	Miles open.
Local authorities	£44,020,317	1,620
Companies	23,279,601	844

Municipalities worked 1,461 of the 1,620 miles owned by them, the remaining 159 miles being leased to companies. The various forms of traction in use were as follows:—

	England and Wales.	Scotland.	Ireland.
Electric	1,923	235	128
Steam	23	—	29
Cable	4	23	—
Gas motors	4	—	—
Horse	83	4	7

Wallasey.—The local tramway scheme has suffered a temporary check. A statutory meeting was held on Wednesday to consider the Tramways Bill now being promoted in Parliament for running a tramway from Seacombe to Poulton, and thence to Wallasey Village, linking up with the present route at New Brighton. The U.D.C. had adopted the Marlowe Road route to Wallasey Village, which, although longer, is estimated to save £12,000 (necessitated by road widening) on the shorter but more popular route by Breck Road. The Wallasey Ratepayers' Association were strongly opposed to the Council's route, and advocated the Breck Road route, which passes through Wallasey Village, as being a more direct line to Seacombe Ferry from the village. A lengthy discussion ensued, and an amendment against the Council's scheme was carried by 126 votes to 120, the effect of which is that the proposed extension, *vid* Mill Lane, Marlowe Road and Claremont Road to Grove Road, is defeated. A poll is to be taken on each portion of the route.

Walsall.—The tramway cars are to be equipped with the British Thomson-Houston electro-mechanical track brakes at a cost of £33 per car set, exclusive of the cost of fixing, which is to be done by the Council's staff. The right to advertise on the tramcars has been let to Messrs. Griffiths & Millington, Ltd., London, for five years.

TELEGRAPH and TELEPHONE NOTES.

Africa.—It is stated that the Government of Uganda recently completed the telegraph line from Port Florence, the terminus of the Uganda Railway, round the Victoria Nyanza, by the installation of the final section up to the German-English frontier on the western shore of the lake at the Kagera. Thus the northern or English half of the lake is entirely included in the telegraph network, whereas on the southern or German shore only Muansa has a connection, this being to Tabora. Bukoba, which is the seat of an important Residency for the control of powerful chiefs and a numerous population, only has communication with the outer world by means of the fortnightly steamers of the Uganda Railway, which convey the mails on their trips around the lake. It is very desirable, therefore, that the telegraph should be extended to this place.

China.—The Diplomatic Body, says Reuter, has made strong representations to the Chinese Government against the action of the Board of Communications in assuming full control of the telegraph office at Pekin, which, according to an agreement arrived at in 1901, was to be placed under foreign superintendence.

High-Speed Telegraphy.—It is reported that official trials are about to be made between London and Paris of the Pollak-Virag telegraphic system.

Manchuria.—The new telegraph agreement between China and Japan has been ratified, whereby the latter transfers to China her telegraph lines in Manchuria outside the railway zone. The agreement also regulates the working of the Chifu-Dairen (Dalny) cable, each nation working its own end of the line.

Telegraphic Interruptions:—

Port Arthur-Chifu	... March 9, 1904
Pontianak-Saigon	... Sept. 16, 1908
Medan-Penang	... Dec. 22, 1908
Malta-Zante	... Dec. 29, 1908
Jamaica-Colon...	... Jan. 9, 1909
Paramaribo-Martinique	... Jan. 11, 1909

Telewriter Exchange.—The Telewriter Syndicate is entitled, under a licence granted by the P.M.G., to establish public exchanges for the transmission of telewriter messages, as well as of telephone messages relating thereto, and the first exchange is to be opened in the City of London. To start the scheme, apparently, a limited number of "original subscribers" will be provided with instruments free of charge, except 1d. per call of three minutes' duration. Connections with post offices will be provided, so that subscribers can write telegrams direct from their own offices. The P.M.G. provides all the lines. Other exchanges will follow.

The New German South American Cable.—It was mentioned a short time ago that a new cable was to be laid between Germany and South America, and the German *Verkehrs Zeitung*, in referring to the question, states that the traffic between the two countries is at present principally effected by way of the Emden-Vigo cable. The telegrams at Vigo are taken in hand by two English companies—the Eastern and Western Telegraph Companies. The return traffic proceeds either *via* the same way or *via* the cable Pernambuco-Fernando de Noronha-Dakar of the South American Cable Co., which is under French influence, and from Dakar *via* the French cable to Brest, or over French and Spanish lines to Tenerife and Cadiz. Owing to the brisk development taking place in the German South American traffic, it is now proposed to provide a special connection with Brazil. The laying and working are to be undertaken by the German & South American Telegraph Co., of Cologne, which was recently brought into existence. As the distance between Germany and Brazil is too great to work a cable direct, sections must be formed, and Tenerife has been selected as the intermediate station. The distance thither amounts to 2,163 nautical miles, and two possibilities come into consideration for the continuation of the cable *via* Tenerife. One is the direct connection, 2,766 nautical miles in length, and the other way is about 1,000 nautical miles longer, *via* Monrovia, the capital of the Negro Republic Liberia, which is still without a cable connection. The latter route might offer the advantage of allowing the German protectorate districts on the West Coast of Africa to be easily connected from Monrovia to the new cable. At present Togo is connected by means of landlines with the Gold Coast and Dahomey, the Cameroons by the English cable Duala-Bonny, and German South West Africa, also by an English cable to Cape Town. It is not yet settled whether the direct route or whether *via* Monrovia will be chosen. Permission to land at Liberia and Brazil has been granted.

The cable is to have one core, and is to be equivalent on the Borkum-Tenerife section to a type of 600 lb. of copper / 340 lb. of gutta-percha per nautical mile, in order to obtain a suitable speed of telegraphy. With the direct route between Tenerife and Brazil, there would have to be employed a type of 650 lb. of copper / 375 lb. of gutta-percha, and a type of 360 lb. of copper / 250 lb. of gutta-percha if the cable were laid *via* Monrovia. The cable is to be worked from Emden from the German side. The connecting section between Borkum and Emden (32·86 miles) is to have two cores, of which one will serve as the earth conductor. The company is under the obligation to start the working of the Emden-Tenerife section by the end of 1909, and the section from Tenerife to Brazil by the year 1911 at the latest.

U.S.A.—The United States Signal Corps now includes 1,212 men, exclusive of officers. A Bill is being introduced, says the *Telegraph Age*, making provision for the doubling of the service. General Allen, the chief of the signal service, in his report for last year estimated the necessary strength at 2,500, or 2½ per cent. of the permitted strength of the army.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney, N.S.W.—April 28th. The Postmaster-General requires tenders for the supply, erection, &c., of a branching metallic multiple magneto switchboard at the William Street telephone exchange, according to specification No. 236. Specification may be seen at the Electrical Review Office. Also see our "Official Notices" December 18th.

Sydney.—February 22nd. Five water-tube boilers, economisers, stokers, feed pumps, pipework, &c., for the Council's electricity department. See "Official Notices" December 11th.

Sydney.—March 1st. Two 1,000-kw. and two 600-kw. motor-generators with starting and regulating apparatus for the Municipal Council. See "Official Notices" January 1st.

An Australian Exchange says that the Brunswick (Vic.) municipality has lately been inviting tenders for street lighting for one, two or three years. Also that the Prahran Tramway Trust will shortly be inviting tenders for plant, &c.

Beckenham.—January 18th. Electric wiring of houses in the U.D.C.'s district. See "Official Notices" January 8th.

Belgium.—The authorities of the town of Hoogstraeten invite applications for the installation and working of private and public electric light and power supply in the town. Address, the Maire, Hotel de Ville.

Birmingham.—February 8th. Stores for the Tramways Committee. See "Official Notices" to-day.

Fareham.—January 20th. Three alternators and exciters, high and low-pressure switchboards, and overhead travelling crane, for the Council. See "Official Notices" December 18th.

Germany.—January 26th. The Finance Deputation of Hamburg is inviting tenders for the supply and erection of 43 electric cranes on the quays.

Tenders are about to be invited by the municipal authorities of Oschatz, Saxony, for the establishment of a central electric lighting station in the town, at an estimated cost of £13,500.

The Direction der K. Eisenbahnen, Altona, requires tenders for 348,720 arc lamp carbons. Specifications are obtainable, against 6d. cash, from the Zentralbureau.

Grimsby.—January 16th. D.C. motors and starting panels (sizes ¼ to 15 h.p.) for the Corporation. See "Official Notices" January 1st.

Halifax.—January 20th. Stores and materials for the Council's tramways and electricity departments. See "Official Notices" January 8th.

Hull.—January 15th. The Corporation Property Committee is inviting tenders for electric light wiring, &c., at the Public Hall, Victoria Square. Plans may be seen and specifications obtained at the office of Mr. Joseph H. Hirst, City Architect, Town Hall.

London.—Islington.—February 5th. Electrical and engineers' stores for the Council. See "Official Notices" to-day.

Hammersmith.—January 27th. One 2,000-kw. steam turbine generating set with condenser for the B.C. See "Official Notices" January 8th.

Plymouth.—January 30th. Stores for the Corporation electricity department. See "Official Notices" January 8th.

Runcorn.—Gas plant required for workhouse. Clerk, Runcorn B. of G.

Sheffield.—February 5th. Stores for the Tramways Committee. See "Official Notices" to-day.

South Africa.—Natal.—Tenders are required by the Durban municipal authorities for electric light fittings for the new Durban Town Hall. Particulars are obtainable from the Agent-General for Natal, 26, Victoria Street, Westminster, S.W.

West Ham.—January 21st. Electrical and other supplies for the Council. See "Official Notices" January 1st.

CLOSED.

Accrington.—The T.C. last week considered the steel roof and girder works required in connection with the extensions at the tramway depôt. The tender of Messrs. E. Wood & Co., of Salford, being the lowest, was accepted.

Australia.—The *Australian Mining and Engineering Review* states that the Electric Light and Power Supply Corporation, Ltd., which holds the rights to supply electricity in Balmain, Sydney, has placed orders for plant to the value of £18,000 as follows:—

Section A.—Boiler house equipment.—Babcock & Wilcox, Ltd.
" B and C.—Two generating sets (500 kw. and 250 kw. respectively), electrically-driven surface condenser, switchboard, transformers, arc lamps, &c.—Staerker & Fischer (representing A.E.G., Berlin), and the Australian General Electric Co. (representing the General Electric Co., U.S.A., and the B.T.-H. Co.).

The same *Review* gives the following list of tenders recently accepted by the Commonwealth P.M.G.'s department, as well as many other contracts of smaller values for insulator buttons, zincs, bolts, cable sheave fittings, brackets, dry cells, &c.:—

Williams & Co., Brunswick.—55,000 stems, £8,333.
J. A. Newton & Co.—Listening keys, switchboards, shutters and buzzers, £845, £208, £131.
India-Rubber, Gutta-Percha and Telegraph Works Co.—8,000 porous pots, £196; 500 earth-plates, £285.
Thornton & Watson, Melbourne.—Telephone apparatus, £5,043.
Dalgety & Co., Melbourne.—20,000 insulators, £194; 100,000 telephone insulators, £1,094.
Noyes Bros., Melbourne.—100 miles of office wire, £637.
British Insulated and Helsby Cables, Ltd., Melbourne.—Wire and switchboards, £3,524.
Western Electric Co., Sydney.—Seven miles of cable, £1,825; 700 telephone translators, £885.
Lohmann & Co., Sydney.—90 miles wire for transfer boxes, £639.
R. Johnson, Clapham & Morris, North Melbourne.—Galvanised iron and wire, £449.
W. T. Henley's Co.—Three miles cable, vulcanised india-rubber-insulated, taped, lead-covered, served, armoured, braided and compounded, £219.
Western Electric Supply Co., Sydney.—Additional apparatus necessary for Brisbane common-battery switchboard, to take current at 220 volts in place of 110 volts.

Adelaide.—The same paper says that the following tenders were received by the City Council of Adelaide for refuse destructor plant:—

Horsfall Destructor Co. ..	£27,631	Heenan & Froude	£18,784
Meldrum Bros...	19,000	Hughes & Stirling	14,136

The city engineer is to report.

Blackburn.—The Corporation on January 7th attached its seal to a contract between the Wigan Coal and Iron Co., Ltd., and the Corporation for the supply of steam coal to the electricity works; also to an assignment by Mr. A. C. Burnley to the Corporation of contracts for advertising on the tramcars.

Canterbury.—The T.C. has accepted the tender of Messrs. Philpot & Son, Canterbury, for electrical work for the ensuing half-year.

Cape Town.—At a meeting of the City Council held on December 10th, the Electric Light Committee reported that it had received a cable from Mr. Long, the electrical engineer, who is at present in London, recommending the acceptance of the tender of Messrs. Siemens, Ltd., for the supply of alternators with Belliss engines, for the sum of £4,146, f.o.b.; and the tender of the British General Electric Co. for a motor-generator, for the sum of £592 15s., erected. The Committee recommended that the tenders in question be accepted, and the Council adopted the Committee's recommendation. With regard to the acceptance of the former tender, a great deal of dissatisfaction is expressed by unsuccessful tenderers, inasmuch as the specification asked for the plant to be delivered and erected, and these firms tendered accordingly.

Dundee.—Messrs. Maxwell & Son have secured the electric lighting contract for new Dens Road School, amounting to £356.

Tenders for the sub-station building, &c., work at Lochee, to cost £1,700, have been accepted.

East Indian Railway.—*Indian Engineering* states that a couple of gas-engine alternator sets required by the East Indian Railway Electrical Department are under supply from home by Messrs. Mather & Platt, Ltd.; switchboard panels, transformers, &c., from the British Westinghouse Electric Co.; and a motor-generator, switchboard, motors, &c., from the Lancashire Dynamo and Motor Co., Ltd.

Felixstowe.—The Council has accepted the tender (the lowest submitted) of the General Electric Co., Ltd., for a 130-kw. Diesel oil engine and electric generator and accessories, including spare parts, at £3,767. The company have undertaken, under heavy penalty, to have the plant ready by the end of June.

Glasgow.—The trustees of the Clyde Navigation have accepted the offer of Messrs. Johnson & Phillips, Ltd., for electric cables, and the Coil Clutch Co., Ltd., for coils, &c., for the 4-ton electric crane at Rothesay Dock.

The Tramways Committee has accepted the following tenders:—

Mountain & Gibson, Ltd.—Rolling shutters for Ruthergien sub-station.
British Thomson-Houston Co.—Oil switches.

Guildford.—For the construction of the foundations of the refuse destructor, the T.C. has accepted the tender of Messrs. Manlove, Alliott & Co., Nottingham (contractors for the plant), at £1,572.

Italy.—ROME.—At the recent adjudication of tenders for apparatus and material for the electric lighting of trains, the administrators of the Italian Government Railways accepted the tenders of Messrs. Ferdinando Gischers, at Turin, and Ch. Fendu, at Vilvoode, Belgium. The first-named firm might advantageously be applied to by British makers.

London.—HACKNEY.—The B.C. has accepted the tender of the Rees Roturbo Manufacturing Co., Ltd., at £54, for an electrically-driven pump for the electricity works.

STEPNEY.—The B.C. has placed another order with Cory Bros. and Co., Ltd., for the delivery, as required by the electricity department, of Pentre washed small coal, at 18s. per ton, a reduction of 5d. per ton on the previous order of 1,000 tons. The contract is up to July next.

BATTERSEA.—The tender of Foster & Co. for the annual supply of coal (Grangerigg washed peas and Mardy Welsh coal) for the generating station has been accepted.

Maidstone.—The T.C. has received the following tenders for cables from the electric light station to Allington sewage disposal works:—

Western Electric Co.	(accepted)	£905
Johnson & Phillips, Ltd.		912
W. T. Glover & Co.		913
Callender's Cable and Construction Co.		916
W. T. Henley's Telegraph Works Co.		929
British Insulated and Helsby Cables, Ltd. ..		937

Middlesbrough.—The T.C. has accepted the tender of Messrs. Crompton & Co., of Chelmsford, for street posts and arc lamps, at £647 10s.

Rawtenstall.—The contract for the raising of the car-sheds, which is necessary on account of the trolley poles, has been let to Mr. Alfred Bentwistle, of Crawshawbooth.

Russia.—The Société Russo-Baltique, of St. Petersburg, has secured a contract for the supply of 60 tramcars with motor equipment for the electric tramways in Moscow.

Selby.—The U.D.C. has accepted the tender of the Bradford Electrical Engineering Co., Ltd., for a storage battery and alterations to switchboard at the waterworks.

Sunderland.—The Lighting Committee recently discussed at length the tenders received for a quantity of cable. All the tenders quoted the same price, and some speakers wanted a strong effort to be made to break through the ring, by accepting a German tender. Mr. Blackman, however, said he did not feel confident concerning the quality to be obtained in Germany, and he preferred to pay the extra price for English manufacture. The tender of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., was accepted.

CONTRACTORS' COLUMN.

[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large, this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

ABERDEEN.—Alterations to theatre in Guild Street (£2,000); electric light to be introduced. Brown & Watt, architects, Union Terrace, Aberdeen.

ABINGDON.—New railway station for the Great Western Railway. G. K. Mills, secretary, G.W.R., Paddington, W.

ABOYNE.—Alterations at Bletsoe, Aboyne. G. B. Mitchell, architect, 148, Union Street, Aberdeen.

ABRAM (near WIGAN).—Developments at collieries. Moss Hall Collieries Co.

ALDERSHOT.—Houses, Institute Road, for Mr. Stent; Halimote Road and Grosvenor Road, for Alderton & Sumpster.

ALTRINCHAM.—County High School. Sankey & Cubbon, architects, 4, Chapel Walks, Manchester.

AMERSHAM (BUCKS.).—Alterations and additions to The Lawns, Pollards Wood; G. E. Nield, architect, 222, Strand, W.C. Two houses, Parkfield Avenue; B. Stone, builder, 85, High Street, Chesham, Bucks.

AMMANFORD (CARMARTHENSHIRE).—Enlargement of Caersalem Welsh Calvinistic Methodist Church.

ASHBURTON (DEVON).—Additions to the Grammar School, for the C.C. (£2,000).

ASHTON-UNDER-LYNE.—Offices for the South-East Lancs. Card and Blowing Room Operatives' Association; Lindley & Gibson, architects, Market Avenue, Ashton-under-Lyne. Probable re-erection (after fire) of shop premises, Stamford Street, for the Meadow Dairy Co.

ASTLEY (near MANCHESTER).—Additional buildings for the Pilkington Coal Co.

BARNSTAPLE.—Alterations to business premises, 59, Bontport Street, for C. R. White, draper, and for H. Carder, draper, Joy Street and Market Street; two dwelling houses at Rackfield Estate, Messrs. Beer, builders, Bishopstawton, North Devon; two dwelling houses at Rackfield Estate, Slee & Son, builders, Barnstaple; two dwelling houses at Coronation Street, and two dwelling houses at George Street, H. Burgess, builder, Barnstaple.

BECKENHAM.—Houses and shops, Westfield Road and Croydon Road, for J. H. Slade; additions to Newholme, Westmoreland Road, for T. Crossley & Sons.

BEDFORD.—New Pavilion and Scrum Hall for Bedford Rugby Football Club (£500). E. H. C. Iliskip, architect, Goldington Road, Bedford.

BEDWELLTY.—Business premises at Blackwood, for G. Davies, Pontillanfraith; twelve houses, Commercial Street, Aberbargoed, for W. Williams & Sons, builders, New Tredegar; development of Gellidywyll Estate for building, D. Lewis, Blackwood.

BEN RHYDDING (near LEEDS).—Two villas. C. H. Brocke, architect, 7, Cookridge Street, Leeds.

BIRKENHEAD.—Extension of hospital, Playbrick Hill. Chas. Brownridge, borough surveyor, Birkenhead.

BIRMINGHAM.—Repairs to the New Peacock, licensed house, after fire.

BIRSTALL (YORKS.).—Houses, Carr House Estate, for J. Akeroyd & Son; Raikes Lane, for E. Smith.

BLACKPOOL.—Tramway shelters and conveniences at Marton. Borough engineer, Blackpool.

BLAINA.—New mixed and infants' school. C. Dauncey, clerk to the C.C., Newport, Mon.

BLANKNEY FEN (near LINCOLN).—Farmhouse for Kesteven C.C. W. Mortimer & Son, architects, Lincoln.

BLYTH.—United Methodist Sunday Schools (£1,200), Waterloo Road.

BOSTON.—Three houses, St. Peter's Lane. J. R. Panton, builder.

BOWDON LODGE (CHESHIRE).—New high school. Sankey & Cubbon, architects, 4, Chapel Walks, Manchester.

BRADFORD.—Library at Manningham (£4,000). F. E. Edwards, architect; W. R. Booth, builder, Pasture Lane, Thornton, Bradford.

BRAINTREE.—Houses, London Road, for H. West and G. Warren.

BRAY (BERKS.).—Alterations and additions to Hill House; also new house, Bray. T. J. Digby, Bray.

BREDBURY (CHESHIRE).—Re-construction of Kelly Hall, Greave Fold, for Mrs. Cheetham; shops and houses at Romiley, for the Compstall Co-operative Society.

BRIDLINGTON.—Residence, North Street, for A. J. Douglas. J. Earnshaw, architect, Carlton House, Bridlington.

BRIGHTON.—Factory, Holland Road, Hove. Parker & Co., builders, Peckham.

BRISTOL.—New elementary school at Soundwell Road, Staple Hill. R. S. Phillips, architect, Midland Bank Chambers, The Cross, Gloucester.

BROADSTAIRS.—Houses, Lindenthorpe Road, for F. W. Ruck; Magdala Road, for A. Foster; alterations to Langside, Albion Road, St. Peter's; H. Noble, builder, Church Road, St. Peter's.

BROMLEY.—Additions, "Mirmar," Madeira Avenue; V. Wilkins, architect, 24, Finsbury Square, E.C. Additions to "Lyncroft," Cromwell Avenue; Potter & Harvey, surveyors, 49, London Road, Sevenoaks, Kent.

BROMSGROVE.—Probable re-erection (after fire) of shop premises, Worcester Street, for Mr. Jones, draper.

BURNLEY.—Four houses in Woodgrove Road; Smith Bros., builders, Burnley. Twelve houses, Holmsley Street; J. Heap, builder.

BURTON-ON-TRENT.—Proposed "Selwyn" Hall at Horninglow. Rev. W. R. Gardner, Vicar of Horninglow Church.

BURY.—New Municipal Secondary School (£12,000 to £13,000). J. T. Halliday, architect, Stockport.

CANTERBURY.—Extensive alterations to premises, 1 and 2, St. George's Street, for F. W. Martin, draper; dairy, 39, St. Peter's Street, for E. and A. Cooper; billiard room, Imperial Hotel, Martyrs' Fields, for H. Doré.

CHEPSTOW.—Improvements and enlargements of Chepstow School. C. Dauncey, Clerk to the C.C., Newport, Mon.

CHESHAM.—House, Holloway Road, Chesham Bois; Hooper & Nash, architects. Alterations and additions to house, Chesham Bois, for F. G. Rust.

CHESTER.—Battery room and other extensions at the electricity works. City Surveyor.

CHIDDINGFOLD (SURREY).—Enlargement of Chiddingfold Schools (£300).

CHORLEY.—Alterations to sawmills, Clifford Street, for P. H. Haydock & Co.; detached house, Highfield Road, for Jas. Brindle & Sons, builders, 88, Clifford Street; new theatre for G. T. Sante.

CHRISTCHURCH.—Drainage School for the T.C. (£37,000).

CIRENCESTER.—Shop, &c., Black Jack Street, for Earl Bathurst; alterations and additions to house, Cecily Hill, for W. H. Saunders.

COCKERMOUTH.—Bungalow, Dean Moor, for A. Watson.

COLLINSTOWN (Co. WESTMEATH).—Alterations and additions to Collinstown Church. L. O'Callaghan, architect, 31, South Frederick Street, Dublin.

COOKHAM.—Three pairs of houses, at Furze Platt, Cookham, for A. Streeter; additions and alterations to "Whyteladyes" for Col. Ricardo, C.V.O., The Elms, Cookham.

COWBRIDGE.—Manse at Maendy. Daniel John, Church Farm, Ystradowen, near Cowbridge.

CRADLEY.—New Mission Church at Cradley Fields (£700). Rev. R. H. Edmondson, vicar.

CREWE.—Shop, end of Smallman Road and Nantwich Road, for W. H. Clews; conversion of houses into shops, Victoria Street, for A. Gilchrist.

CROYDON.—Enlargement of laundry, Sunnybank, South Norwood, for F. & G. Foster; conversion of houses into shops, for J. Laing & Co., Station Road, South Croydon; eight houses, Nutfield Road, for G. Poulton, 11, Westbrook Road, Thornton Heath; Mission Hall, Hythe Road, Thornton Heath, for S. Buxton, 40, Burlington Road, Thornton Heath; two houses, Leander Road, for A. C. Clout, Thornton Heath; eight houses, Coniston Road, for F. Bates, 27, Queen Victoria Street, E.C.

CWMFELINFACH (MON.).—Seventeen houses, Maindee Road (£3,660). J. W. Aldiss, architect, Newbridge (Mon.); W. Phillips, builder, Ynysddu (Mon.).

DALKEY (Co. DUBLIN).—Proposed new dispensary, for the Board of Guardians. P. Cunniam, clerk to the B. of G.

DARLASTON.—New Handicraft Centre, on site of the Central Council School. G. Balfour, Director of Education, County Education Offices, Stafford.

DARTFORD.—Six houses and shops, Great Queen Street, for H. Mitchell; bottling store, Dartford Brewery, for the Dartford Brewery Co., Ltd.; three houses, East Hill, for J. Wyatt; eleven houses, Heath Lane, for Cracknell Bros.

DARTON (YORKS.).—New schools (£2,945). G. H. Mellor, builder, Barnsley.

DONCASTER.—Villa residences on site of Broxholme House. Wm. Howitt, builder, Christ Church Road, Doncaster.

DUBLIN.—New ward block and boiler house at the Military Hospital, Arbour Hill; director of Barrack Construction, 80, Pall Mall, London, S.W. Proposed fire station in Thomas Street, for the Corporation.

DUKINFIELD.—New Primitive Methodist schools (£1,800).

DUNDEE.—Warehouse for J. N. Kyd & Co., Dundonald Street; new warehouse, in Longair Street, for Grant & Baxter; alteration to property, for Thomas A. Whitton, Loons Road; new warehouse, for H. Boase & Co., manufacturers, Morgan Street; alteration on property, for Mrs. Haggart, Strathmartine Road; extensive additions and alterations for Smith Bros., The Globe, Murraygate, Dundee; proposed district halls, James Thomson, city architect, Dundee.

DURHAM.—Houses, High Wood View, for Beevers & Clark, builders. School, Mount Pleasant; W. Rushworth, architect, Shire Hall, Durham.

EASTBOURNE.—Additions to York House, Royal Parade, for D. E. Williamson; Spalding, Spalding & Myers, architects. Ten houses, Desmond Road; Mitchell & Ford, architects, 7, Gildredge Road, Eastbourne; A. E. Potter, builder. Extension to Beach Laundry, Royal Parade, East, for the Beach Laundry Co.; J. D. Thompson, builder. Prospective restoration, after fire, of premises, 2, Furness Road, for J. Hyde, baker and confectioner. Addition and alteration to Holy Trinity Church; A. R. G. Fenning, architects, 46, Lincoln's Inn Fields, London, W.C. Improvements to pier entrance, including eight new kiosks; P. D. Stonham, architect, 17, Gore Park Road, Eastbourne.

ECCLES.—Houses in Corporation Road, for the Corporation. L. Barlow, architect, 8, King Street, Manchester.

ELLESMERE PORT.—Houses, Church Street, for J. Harper.

EXETER.—Extensions to the Asylum, for the T.C. (£10,000).

FALMOUTH.—Proposed new docks and railway scheme (£687,500), J. H. Ryan, engineer; two houses in Melville Road, for Eva & Bone, Falmouth.

FELTHAM (MIDDLESEX).—Wesleyan Church, Hanworth Road, C. P. Baker, Charlecote, Hounslow Road, and A. A. Moore, Cotham Villa, Victoria Road, joint treasurers.

FOLKESTONE.—Additions to 8, Wiltie Gardens. A. R. Bowles, architect, The Parade, Sandgate.

GILLINGHAM.—Houses, Chatsworth Road, for V. Tewell; F. D. Pott, architect. Wesleyan Sunday School, Byron Road; G. E. Bond, architect, Victoria Buildings, 384, High Street, Rochester. Sixteen houses, Eva Road, for Mr. Richardson.

GLASGOW.—Improvements in the lighting of St. Enoch's Church. Town Clerk.

GLASS HOUGHTON (YORKS.).—New hotel for Mrs. Pickersgill.

GOLBORNE (SOUTH LANCS.).—Important alterations proposed at the Queen Anne Inn.

GOSPORT.—School, Grove Road, Hardway (£5,600). E. J. Tench, architect, Norwich; John Hunt, builder.

GREENOCK.—New Higher Grade School in Patrick Street; W. R. Watson, architect, 689, Great Western Road, Glasgow. Repairs to the Drill Hall of the Fifth Battalion Argyll and Sutherland Highlanders (after fire).

HALE (CHESHIRE).—New Higher Elementary School in Queen's Road. P. D. Lodge, architect, Manchester.

HANLEY.—New shop premises, Market Square, and alterations to existing premises (£3,040). R. Scrivener & Sons, architects, Wellesley Street, Hanley; T. Godwin, builder, Victoria Road, Hanley.

HARROGATE.—Purification and sludge disposal works, including pumping plant, for the T.C. (£4,500).

HASTINGS.—Prospective rebuilding (after fire) of works in Waterworks Road, for Tanner & Co., furniture removers, &c.; alterations and additions to Holmhurst, Law & Harris, architects.

(ST. HELENS).—Mansion, Baldslow, for Lady Kennedy.

HEATON.—Villa, Albert Road. E. Moss.

HERNE BAY.—Bungalow, Reculver Road; H. E. Ramsey & Co., Sea View Road. Bakery and new shop front, 32, Gloucester Place, High Street, for C. F. Hunter.

HIPPERHOLME (near HALIFAX).—Probable reconstruction (after fire) of works for the Leeds Fireclay Co.

HITCHIN.—Motor garage, Walsworth Road, for R. G. Sanders & Sons; J. Willmott & Sons, builders, 80, Walsworth Road. House, London Road, for A. Hill.

HOCKLEY (ESSEX).—Probable re-erection (after fire) of Maisonette, Station Road, for F. West.

HOUGHTON-LE-SPRING.—Underground public convenience, for the U.D.C. Surveyor to the U.D.C.

HOYLAND (YORKS.).—New schools (£2,713). Blakeley & Co., builders, New Wortley, Leeds.

HUDDERSFIELD.—Detached house, Fartown. N. Culley, architect, 13, John William Street, Huddersfield.

ILFRACOMBE.—New post office for H.M. Office of Works. Postmaster, Ilfracombe.

IPSWICH.—Important alterations to business premises for Frank Mason, draper, Tavern Street and Tower Street.

KEARSLEY (near BOLTON).—Proposed new Council School in Bolton Road. Secretary, Education Committee, Kearsley, Bolton.

KETTERING.—Houses, Park View, for H. Ball.

KILLAY (GLAM.).—New school for the C.C. Hartland, Isaac, Watkins and Lewis, 7, Rutland Street, Swansea.

KINGSTOWN (Co. DUBLIN).—Dispensary and caretaker's residence in Patrick Street, for the Rathtown Union. G. T. Moore, architect, 1 and 2, Foster Place, Dublin.

KIRKBY-IN-ASHFIELD (NOTTS.).—Houses, Vernon Road, for Mrs. Nixon; Unity Street, for D. Maddock.

KIRKHAM (LANCS.).—New County School in Station Road. Surveyor, Council Offices, Kirkham.

KNUTSFORD.—Probable re-erection, after fire, of Hulme Corn Mills, Allostock.

LEICESTER.—Proposed public hall in Regent Road (£15,000). Boulton and Paul, Ltd., Norwich.

LEIGH (LANCS.).—Seventeen houses, Manchester Road; J. W. Cowburn, builder. Opening old mines and tapping new seams; Ackers, Whitley & Co., Plank Lane Collieries.

LEWES.—Villa residence, Malling Hill, for James Vinall.

LIMAVADY (Co. DERRY).—Projected Carnegie Free Library.

LINCOLN.—Chapel, &c., at Scampton. Rev. A. Morter, 102, Burton Road, Lincoln.

LISCARD (CHESHIRE).—Two semi-detached villas in Peckett Road. F. J. Broadbent, contractor, 16, Caithness Drive, Liscard.

LITHERLAND (near LIVERPOOL).—Cookery and laundry centre in Lander Road. H. Littler, architect, 16, Ribblesdale Road, Preston.

LIVERPOOL.—New Elementary Schools at Rawson Road, Seaforth, and Crosby Road, Waterloo, for Seaforth and Waterloo U.D.C.; terrace of houses, West Derby Road, Tuebrook, R. Jones, builder, Littledale Road, Seacombe, Chester; workshops for the blind, Cornwallis Street, Holt & Glover, architects, 42A, Imperial Buildings, 20, Exchange Street East, Liverpool.

LONDON (WIMBLEDON, S.W.).—Pair semi detached houses, Cambridge Road; Daw, Saville & Co., surveyors, 217, Chancery Lane, W.C. Sixty-one houses in Ashen Grove and in Melrose Avenue; C. Barwell, 2, Ravelstake Road, Battersea, S.W. Pair semi-detached houses, Cambridge Road; A. Lyon, 97, Hartfield Road, Wimbledon. Florists' workshop at 70, Home Park Road; Luff & Sons, Wimbledon Park. Extensions of offices at L. and S.W. Railway Station, Hill Road; A. W. Cooper, surveyor, 85, Gresham Street, London, E.C. Four houses, Albert Road; W. Rawlins, surveyor, 45, King William Street, E.C.

(STRATFORD GREEN, E.).—New drill sheds, and converting existing drill hall into riding school, &c. Secretary, Territorial Force Association, Essex County, 2, Eldon Street House, E.C.

(WALWORTH, S.E.).—Building at corner of Thornton Street and South Street. T. W. Sloman, junr., builder, South Street, Walworth, S.E.

(PADDINGTON, W.).—Elementary school (450 places), Kilburn Park Road. Rev. P. H. Leary, vicar, St. Augustine's, Kilburn Park Road.

LONDON (HENDON, N.W.).—Alterations to "The Homestead," Stanmore Hill for Mr. Woodman.

(PECKHAM, S.E.).—Rebuilding of premises (after fire), for Messrs. Cartwright, furnishers.

(WHITCOMB STREET, W.).—Buildings in Spur Street; Bywaters and Sons, Kingly Street, Regent Street, W.

(HOLBORN, W.C.).—Extension of premises for Buchanan & Co., distillers. F. G. Minter, builder, High Street, Putney.

(LAMBETH, S.E.).—Extensions to Summerstown Undenominational Mission, Blackshaw Road, for the trustees. Buildings in Ferry Street, for Doulton & Co.; Buckland & Garrard, surveyors, 8, Frederick's Place, E.C.

(LEWISHAM, S.E.).—Six houses, Belmont Hill; H. and G. Taylor, builders, Boyne Road, Lewisham. Four houses, Gaynesford Road; E. C. Christmas, builders, 55, Dartmouth Road, Lewisham.

(MAYFAIR, W.).—Mansions in Park Street and Upper Grosvenor Street. W. D. Caröe, architect, 3, Great College Street, S.W.; Higgs & Hill, Ltd., builders, South Lambeth Road, S.W.

(MUSWELL HILL, N.).—New St. Peter's Church, Colney Hatch Lane: Caröe & Passmore, architects, 3, Great College Street, Westminster, S.W.

(CANNING TOWN, E.).—Alteration, provided school, Hermit Road. W. Jacques (Newman & Jacques), architect, 2, Fen Court, Fenchurch Street, E.C.

(STRATFORD, E.).—Billiard showroom, rear of The Grove, for J. Ascott, 51, Station Street, Stratford. Additions and alterations, "Tidal Basin" Tavern, Tidal Basin; A. Single, 85, The Grove, Stratford. Store, Lucas Road; Coult, Son & Co., builder, 7, Stracey Road, Forest Gate. Additions to brush works, for G. A. Diggins, 50A, Romford Road. Addition to workshops, Leytonstone Road, for The Continuous Counter Check Co., 14 and 14A, Leytonstone Road, Stratford.

(CLAPHAM, S.W.).—Factory, rear of Clapham Park Road and North Road. F. and H. F. Higgs, builders, 41, Gresham Street, E.C.

(DEPTFORD, S.E.).—Branch library, New Cross Road (£4,500). Borough Council.

(S.W.).—Additions to Westminster School. A. H. Tiltman, architect, Raymond's Buildings, W.C.

(UPPER HOLLOWAY, N.).—Improved receiving ward accommodation at the St. John's Road Workhouse. W. Lockwood, architect, 12, Sherwood Street, Piccadilly Circus, W.

(SILVERTOWN, E.).—Addition to machine shop at Moreland and Sons' premises.

(FOREST GATE, E.).—Van shed and cash store for M. Price & Co. Chaucer Road, Forest Gate.

(W.).—Rebuilding 27 and 23, Oxford Street, for Parkins & Gotto, stationers. Rebuilding 163, Oxford Street, and 35, 36 and 37, Poland Street; Phillips & Co., agents, 6, Newman Street, W.

LUTON.—Houses, Dudley Street, for G. Brown; Clipstone Road, for J. Frost; Selbourne Road, for C. H. White, builder, 72, Dunstable Road; Kenilworth Road, for W. Frost; Westbourne Road, for A Smith Stores; Dunstable Road, for S. G. Parker.

MAESTEG.—New Co-operative Stores. Evans & Jones, architects, 5, Station Road, Port Talbot.

MAIDSTONE.—Seven houses, Pope Street, for G. T. Large. Six houses, St. Philip's Avenue; Clarke & Epps, builders, Cornwallis Road.

MANCHESTER.—New secondary school for girls in Chorlton Street; Chairman, Elementary Education Committee, Deansgate, Manchester. Probable rebuilding, after fire, of Hollingworth Congregational Church; Rev. E. Slater. Important alterations to business premises, including new electric passenger lift, for Mack Hamilton's (Bellamys, Ltd., proprietors), furnishers, Oldham Street.

MANSFIELD.—Rebuilding Bull's Head Inn, for the Nottingham Brewery, Ltd. Sutton & Gregory, architects, Bromley House, Nottingham.

MARGATE.—Restoration, after fire, of the Albion Hotel, King's Street.

MELBOURNE (DERBYSHIRE).—Boiler houses, for Wilson & Co., boot manufacturers; business premises, Derby Road, for A. Knowles.

MERTHYRTYDFIL.—Lock-up shops and lavatories, Pontmorlais, for the T.C. (£650); Borough Surveyor. Extensions to Mardy Hospital (£3,370); D. Davies & Sons, builders, Trade Street, Cardiff.

METHLICK (ABERDEENSHIRE).—Alterations at the U.F. Church. D. & J. R. McMillan, architects, 105, Crown Street, Aberdeen.

MIDDLESBROUGH.—Probable reinstatement (after fire) of premises for Dorman, Long & Co., engineers.

MILNROW.—Proposed new Primitive Methodist Church.

MINEHEAD.—New residence on North Hill, for R. H. Holman. Andrews and Hosegood, architects, Williton.

MORECAMBE.—Completion of The Tower Buildings for W. Hardcastle, Scarborough; H. J. C. Smith, architect, 2, Hogmoor Road, Blackmoor, West Liss, Hants.; T. J. Hawkins & Co., contractors, Westminster, S.W. Bandstands, shelters, &c., on the sea front, for the T.C. (£6,250).

NEWPORT (MON.).—Extensive alterations to business premises, Commercial Street, for W. Pritchard & Co., drapers. Harris & Sheldon Ltd., contractors, Stafford Street, Birmingham.

NEWQUAY.—Laundry premises on the sea front (£1,300). Town Council.

NEW ROSS.—New technical institute. A. O'M. Lovell, architect.

NORMANTON COMMON (YORKS.).—Fourteen houses. Garside & Pennington architects, Pontefract.

NORTHAMPTON.—Probable re-erection, after fire, of shoe factory at Cogenho for T. C. Mann & Sons (lit by electricity). Houses, Monks Park and Willingborough Road (development of estate). W. D. Gibbins, architect, 5, St. Giles Street, Northampton.

NORTHUMBERLAND.—New county schools at Forest Hall, Longbenton (370 places); Nedderton, Bedlingtonshire (300); Whitley South (600); Bedlingtonshire (120); Willington Quay (120); and Gosforth (120); C. D. Forster, deputy clerk, The Moot Hall Newcastle.

NORTH WALSHAM.—New school (240 children). Thos. A. Cox, secretary to Norfolk Education Committee, Shirehall, Norwich.

OAKHAM.—Rebuilding business premises, Mill Street, for Jermyn & Perry, drapers. Wm. Jarvis & Son, architects, Paradise Parade, King's Lynn.

OTTERY ST. MARY.—New school for Devon C.C. (£6,500).

PAIGNTON.—Development of estate, Preston Sands Lane, Torquay Road, fo building. Paris E. Singer, Oldway House, Paignton.

PENMAENMAWR (CARNARVONSHIRE).—Recreation room for Col. Darbishire additions to Salem Chapel.

PORTSMOUTH.—Houses, Hayling Avenue; W. Farminer, 62, Malins Road, Landport. Houses, Knox Road; W. Coles. Two houses, London Road; W. Mitchell. Motor house at Craneswater, Southsea, for Sir W. T. Dupree.

POULTON (LANCS.).—New buildings in connection with the extension of the refuse destructor, Gorsey Lane, for the Wallasey U.D.C. W. H. Travers, district surveyor, Public Offices, Egremont Cheshire.

PRESTWICK.—Addition to Crippled Children's Home. J. K. Hunter, architect, 51, Sandgate, Ayr, N.B.

RAVENSTHORPE (YORKS.).—Four houses for G. H. Peace, Calder Road.

READING.—Residence in St. Anne's Road, Caversham; O. Phillips, 22, Upper Redlands Road, Reading, builder. Residence in Whitley Wood Road for E. J. Jarvis. Conversion of Pendennis, Oxford Road, into shops; Allaway Bros., builders, 102, Oxford Road, Reading.

ROMFORD.—Extensive alterations at the Great Eastern Railway Station.

ROTHERHAM.—Club premises at Thrybergh. P. A. Hinchcliffe, architect, 14, Regent Street, Barnsley.

ROYTON (LANCS.).—Proposed new church institute; Rev. J. H. Humphrey, vicar. Houses and shops, Oldham Road, for J. W. & H. Beswick, builders, Longsight, Royton.

RUGBY.—House and shop, Regent Street, for W. G. Varney. Electric light to be installed at new St. Peter's Church.

RUISLIP-NORTHWOOD.—Proposed Post Office. H.M. Office of Works, Storey's Gate, S.W.

SACRISTON (Co. DURHAM).—Workmen's Club. G. T. Wilson, architect, 22, Durham Road, Blackhill, Co. Durham.

SADDLEWORTH.—Garden City scheme, to be carried out by Greenfield Co-operative Society (£5,000).

ST. ALBANS.—New premises for the Allbright Dental Institute, Ltd., 42, Bishopsgate Street Without, London, E.C.

ST. ANNE'S-ON-SEA.—Seven villas; Surveyor, Council Offices, St. Anne's. Houses, Lord Street, for J. Whiteside; detached residence, St. Anne's Road East, for Mrs. Martin.

ST. NEOTS.—Prospective restoration (after fire) of roller flour mills, for Paine and Co., Ltd.

SALFORD.—Prospective rebuilding (after fire) of premises for Langwerthy Bros., manufacturers, Greengate, Salford.

SALISBURY.—Alterations to business premises, for Hobden Bros., drapers, Silver Street.

SALLINS (Co. KILDARE).—New R.C. church and schools (£1,200).

SANDWICH.—Motor garage for Dr. Day; house, Sandown Road, for Mr. Peto.

SEVENOAKS (OTFORD).—Repairs to the North Isolation Hospital and rebuilding operations. G. F. Carnell, Clerk to the Council, 130, High Street, Sevenoaks.

SHEFFIELD.—Two detached villas at Dore. J. W. Winter, architect, St. Peter's Close, York Street, Sheffield.

SHEFFORD (BEDS.).—Probable reinstatement (after fire) of portion of St. Francis Home.

SHELF (near HALIFAX).—Houses, Belle Vue, for Arthur Holdsworth and Mrs. E. A. Trotter.

SOUTHEND-ON-SEA.—Reinstatement (after fire) of premises (lit by electricity), for Dennis Broughton, house furnisher, Leigh Road, Westcliff.

SOUTHPORT.—Primitive Methodist Church, Hesketh Lane, Tarleton. T. Abram, builder, Banks, Southport.

SOUTH SHIELDS.—Extensive additions to Russell Street Post Office.

SPALDING.—Pair of semi-detached villas, Park Road, for C. D. Waite.

STILLORGAN (Co. DUBLIN).—Dispensary and caretaker's residence, for the Rathdown Union. G. T. Moore, architect, 1 and 2, Foster Place, Dublin.

STOKE-ON-TRENT.—Proposed semi-detached villas, Edward Street, for W. and H. Goss; addition to Egerton House, Hartshill, for G. L. Jones; fourteen houses, Gladstone Street, for S. Heath; conversion of the Signal Inn into shop and dwelling house for A. Brayford.

SWANSEA.—Six houses, Port Tennant, for the Harbour Trust. T. Strick, clerk to the Trustees.

TAUNTON.—New headmaster's residence at Taunton School (£2,000), close to electric main; also new bathrooms; Dr. Whittaker, headmaster.

THORNE (near DONCASTER).—Co-operative Stores. H. Beck, architect, Doncaster.

TIPTON.—Prospective restoration, after fire, of premises in Market Place, Great Bridge, for O. Rutton, tobacconist.

TONBRIDGE.—Villas, Goldsmid Road, for W. J. Fairservice; additions to Woodlands Laundry, for the Misses Chandler.

TOTTINGTON (near BURY).—Important sewerage scheme contemplated. Surveyor, Tottington District Council, Lancs.

TREBOROUGH (SOMERSET).—Additions to Council School (£400). G. T. Simey, clerk to Somerset County Council, Bath.

TREORKY.—Twenty-two houses at Kenry Street, Ynyswen. W. D. Morgan, architect, 194, Ystrad Road, Pentre, Rhondda.

TRURO.—Residence and club house, for J. Bray. L. Winn, architect, Boscawen Street, Truro.

TUNBRIDGE WELLS.—House and shop, St. John's Road (£1,700), for E. & H. Kelsey, brewers; two houses, Culverden Avenue, for A. E. Avon; additions to 33 to 37, Grosvenor Road, for W. G. Harris and Co., furniture removers.

TUNSTALL.—Repairs to premises in Market Square, after fire, for D. Wilson draper and milliner.

TURTON (near BOLTON).—Proposed Mission Room at Longworth and Recreation Room at Deeph. Surveyor, Council Offices, Turton.

TWYFORD.—Proposed enlargement of the Parish Church. Vicar of the Parish.

WADEBRIDGE (CORNWALL).—Houses, Glen Road, for Brown Bros.

WAKEFIELD.—New Empire Music Hall, for Sherwood & Co. F. Matcham, architect, 9, Warwick Court, London, W.C.

WALKDEN.—Colony of model houses. W. Hall, manager, Walkden Co-operative Society, Manchester.

WARRINGTON.—Rebuilding of premises for the Equitable Industrial Co-operative Society.

WATFORD.—Adaptation of old grammar school for higher elementary school; A. R. S. Hallidie, secretary to Herts Education Committee. New school, Derby Road, for the Herts County Council. New grammar school, Cassiobury Park; Governors, Grammar School, Watford.

WEMBLEY.—Two houses, Ealing Road, for W. Batten; four houses, Linden Avenue, for S. H. Hannington; 28 houses, Thurlby Road, for J. W. Camben. Additions to the public offices; E. R. W. Chapman, surveyor to the Urban District Council.

WEST HARTLEPOOL.—Villa, Miller Road, and Grosvenor Street; Walter Watson, Clifton Avenue. Seven houses, Pemberton Road; J. Brown, Stockton Street. Motor house, Stanhope Avenue; W. Turner, Stanhope Avenue. Two houses and stable, Bolton Grove, for E. M. Tweddle, Osborne Road; W. Young, architect.

WICK, N.B.—New temperance hall. New post office at Strathnaver; Postmaster, Wick.

WIGAN.—Rebuilding premises corner of Chapel Lane and Darlington Street for S. C. Ellison; 50 houses for the Corporation tramway employés (£11,100); houses, William Street, for Wm. Knowles, and Ridyard Street, for A. Swift.

WINDERMERE.—Bank premises, Crescent Road, for the Bank of Liverpool, Ltd.

WISBECH.—Elementary school for Norfolk C.C. at Walsoken. Thos. A. Cox, secretary to the Education Committee, Shire Hall, Norwich.

WITHAM (ESSEX).—Houses, Albert Road, for the Co-operative Society; Collingwood Road, for W. P. Perkins.

WIVELISCOMBE (SOMERSET).—Extensive additions to Bittiscombe Manor, residence of Sir John Fergusson Davie, Bart. Pollard & Co., builders, Taunton.

WOLVERHAMPTON.—Extensive alterations to premises, 23, Queen Street, for Henry Huse, outfitter.

WOOLAVINGTON (SOMERSET).—Enlargement of schools (£450). Managers.

WORTHING.—Houses, Ham Road; T. R. Hyde, architect. Houses, Browning Road, for G. N. Newman; Hyde & Son, architects, 23, Enswell Road, Worthing. Houses, Archibald Road, for Apted, Greenfield and Co.; house and shop, Church Walk, for J. Randall; additions to Lavender Laundry, for F. and G. Miles.

YARMOUTH.—Seven houses, Clarence Road, Gorleston, for W. T. England; eight houses, Avondale Road, Gorleston, for Mr. Fleming; house, Albany Road, South Town, for H. Harper; Palgrave Road, Yarmouth, for W. J. Burwood; alteration to Wellington Lodge, Marine Parade, for Mrs. Hewson; six houses, Springfield Road, Gorleston, for R. S. Cockrill.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, January 15th. At 8 p.m. At the Technical College, Glasgow. Paper on "Balancing on Three-Wire Systems," by Mr. A. Thompson.

Friday, January 22nd.—Visit to Queenslie Coal Pit, Shettlestone.

Northampton Institute Engineering Society.—Friday, January 15th. Paper on "Proportionment of Armature Teeth," by Mr. H. K. Whitehorn.

Friday, January 22nd.—Visit to the Board of Trade Laboratory, Whitehall, S.W.

Junior Institution of Engineers.—Saturday, January 16th. At 3 p.m. Visit to the engineering laboratories and workshops of the Central Technical College, South Kensington S.W.

Birmingham and District Electrical Club.—Saturday, January 16th. At 7 p.m. At the Colonnade Hotel, Birmingham. Presidential address by Mr. G. T. Wood.

Institution of Civil Engineers.—Tuesday, January 19th. At 8 p.m. Further discussion of papers on "High Speed on Railway Curves," by Mr. J. W. Spiller; and "A Practical Method for the Improvement of Existing Railway Curves," by Mr. W. H. Shortt.

Wednesday, January 20th.—Students' visit to the Royal Mint.

Royal Society of Arts.—Monday, January 18th. At 8 p.m. Lecture on "The Public Supply of Electric Power in the United Kingdom," by Mr. G. L. Addenbrooke.

Institution of Electrical Engineers (Newcastle Section).—Meeting of January 11th postponed to January 18th.

Institution of Electrical Engineers (Students' Section).—Wednesday, January 20th. At 7.45 p.m. At the Library of the Institution. Paper on "Modern Mining Switchgear," by Mr. J. F. Shipley.

Royal Institution.—Thursday, January 21st. At 3 p.m. Lecture on "Mysteries of Metals," by Prof. J. O. Arnold. (Lecture I.)

Physical Society.—Friday, January 22nd. At 5 p.m. At the Royal College of Science, South Kensington, S.W. Papers on "The Effective Resistance and Inductance of a Concentric Main, and Methods of Computing the Ber and Bei," by Dr. A. Russell; "The Luminous Efficiency of a Black Body," by Dr. C. V. Drysdale; and "The Use of the Potentiometer on Alternate-Current Circuits," by Dr. C. V. Drysdale.

Institution of Electrical Engineers (Manchester Section).—Tuesday, January 26th. At 7.30 p.m. At the University, Manchester. Paper on "Parallel Operation of Alternators," by Dr. E. Rosenburg.

Institution of Electrical Engineers (Leeds Section).—Wednesday, January 27th. Meeting at the University, Sheffield.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, January 18th.—"A" Company. Infantry drill (recruits), 6 to 7 p.m. Technical drill, 7 to 10 p.m.

Tuesday, January 19th.—"B" Company. Technical drill, 6 to 8.30 p.m. Infantry drill, 8.45 to 9.45 p.m.

Tuesday, January 19th.—Medical inspection for recruits, 6.30 to 7.30 p.m.

Thursday, January 21st.—"C" Company. Infantry drill (recruits), 6 to 7 p.m Technical drill, 7 to 10 p.m.

Friday, January 22nd.—"D" Company. Infantry drill (recruits), 6 to 7 p m Technical drill, 7.15 to 9.30 p.m.

Arms will be issued to recruits on January 18th, 19th, 21st and 22nd.

Saturday, January 30th.—"A" Company. Week-end run at Coalhouse Fort. Members wishing to attend must send in their names not later than the 25th inst.

(Signed) J. H. S. PHILLIPS,
Capt. and Acting Adjutant.

NOTES.

To Electrical Manufacturers.—In our issue of January 1st an advertisement was published asking for tenders for electrical work required at a proposed new factory at Cardiff, for the Boston Collapsible Barrel and Manufacturing Co. We have received communications from several electrical firms on the matter, and if any other firms have replied to the advertisement, we shall be glad if they will advise us of the fact.

Fire.—It is reported in the Press that while a motor-car was being overhauled in a private motor-house at Selmeston last Saturday, the bulb of an electric lamp, which was attached to a flexible cord, broke, causing the petrol fumes to ignite. The car was destroyed, and the driver somewhat burned.

Annual Dinner.—On the first night of the new year the annual dinner of the staff of the Western Union and Telegraph Co. was held at Western Hotel, Penzance, with Mr. J. C. Truscott in the chair. A smoking concert followed, at which Mr. G. Adson presided.

A Novel Process of Telephotography.—Mr. C. M. Senlecq, of Ardres, France, should be mentioned foremost among the inventors whose arduous labour has been devoted to endeavours to solve the problem of telephotography. While in his earlier arrangements he employed as sensitive organ a selenium cell, as used, for instance, in the Korn apparatus, this inventor, owing to the inertia and variations in sensitiveness of this substance, eventually tried to design some suitable substitute.

The relief process first suggested by Amstutz, of Cleveland, Ohio, which has been taken up recently by Belin, shares with the selenium process the disadvantage of its slowness in transmission, and, moreover, requires the laborious preparation of a bichromate gelatine copy of any photograph to be transmitted. As a gradual shortening of the time of transmission, eventually leading to a solution of the tele-vision problem, cannot thus be anticipated, Senlecq, after numerous experiments in different directions, decided on the use of the following principle, which is free from the above drawbacks.

The conversion of luminous shades into variations of current intensity is effected without any specially prepared plates, immediately in the photographic camera, and, in fact, does not entail any special manipulations. The light rays strike, in the focus of the camera, a slide covered at its front with a glass plate and designed at its back as a microphone, connected with the transmission line in the same way as the microphone of a telephone plate.

The interval between the glass plate and the microphone, which is only about 1 in. in thickness, is filled with a mixture of hydrogen and chlorine gases prepared in the dark under a given pressure. The glass plate inside the camera is covered with a rotary screen in which are a series of openings arranged in spiral lines (fig. 2), which is designed accurately like the one used in the selenium apparatus of the same inventor, but the selenium specks are replaced by perforations.

In fig. 1, F is the plate of an Ader microphone consisting of a very thin plate or a membrane, the vibrations of which correspond to the light shades acting on the gas mixture; G, in fig. 2, is a screen 1 metre or more in diameter, which, during each rotation, covers every portion of the picture in very close line. The two gases are contained in opaque receptacles H, Cl. The glass plate, in a state of rest is covered by the screen. The conversion of the different light shades into fluctuations of current intensity takes place as follows:—

A mixture of equal volume parts of chlorine and hydrogen can be maintained only in perfect darkness. Under the action of even diffuse light, a combination of the two gases to hydrochloric acid takes place at a rate corresponding to the variable luminous intensity; in fact, in bright sunlight, this combination is so violent as to result in explosion.

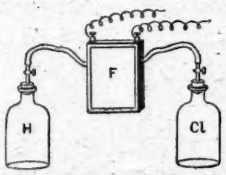


FIG. 1.—THE SENLECQ TRANSMITTER.

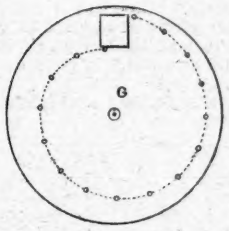


FIG. 2.—DISTRIBUTING DISK.

Experiments conducted by the inventor show the combination of the two gases in the camera always to occur instantaneously, exerting on the microphone plate an action identical to that of sound vibrations. The phenomenon in question, from being electrical, thus becomes a purely chemical effect producing a mechanical action—viz., vibrations of the microphone, which in turn are transmitted to the remote end of the line, in the shape of electric fluctuations. Owing to its strong chemical affinity for water the hydrochloric acid is absorbed immediately after production.

The luminous shades of the original picture are thus converted into microphone vibrations which in turn, with fluctuations of electric current, are transmitted to the receiving station, there to be used for reproducing the picture by means of any tele-photographic receiving apparatus. The inventor uses in this connection his tele-electroscope and shade scale.

The main advantage of this process, according to the above, is the remarkable rapidity of transmission, any picture being transmitted in a few seconds. The process thus constitutes a considerable step towards the solution of the tele-vision problem.

The Silvertown "Marathon" Race.—On Saturday last a 10½-mile road race was contested by 37 employés of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E. This local "Marathon" created tremendous interest, thousands of spectators lining the route, which was a circular one, commencing and finishing at the Eagle Hotel, Snaresbrook. G. Peters won the race in 63 minutes, excellent time considering the heavy "going."

Prof. Ayrton's Will.—The late Prof. W. E. Ayrton, F.R.S., who died last November, has left gross estate amounting to £43,590, the net personalty being £42,977. Probate has been granted to Mrs. Hertha Ayrton, and the late professor's two daughters (Miss Barbara Bodichon Ayrton and Mrs. Edith Ayrton Zangwill).

Birmingham High-Tension Consumers' Dinner.—An interesting event took place on Tuesday, the 5th inst., when the representatives of electrical contracting firms gave a dinner to the Birmingham manufacturers who are taking high-tension current from the Corporation mains. The contractors concerned (British Westinghouse Co., Siemens Bros., General Electric Co., and British Insulated Wire Co.), generously invited the Corporation engineers to join them, and the chair was occupied by Mr. Milns, of the Birmingham Corporation. Speeches showed that the very best feelings existed between the consumers, the electrical contractors, and the Corporation engineers, and in emphasising this, Mr. Milns pointed out that it was the result of the Corporation's endeavour to conduct the undertaking on sound and straightforward lines, and to conscientiously consider the interests of the consumer. He also attributed this friendly feeling to the personality of the leading Birmingham manufacturers, and spoke highly of the plant supplied by the various electrical firms. We are informed that the good fellowship existing was such that the party did not break up until 5 a.m. the following morning.

The Boston Elevated Railway Co.—The *Light Railway and Tramway Journal* for November prints the result of an interview with Mr. C. S. Sergeant, vice-president of the Boston Elevated Railway Co. Some of the more interesting replies are given here:—

Compensation is paid to learners for their time.

A guaranteed minimum wage is paid to new or extra men.

Increased compensation is given to long-service men, and pensions under certain conditions.

"Satisfactory service" money is paid in sums of $15 to employés deemed worthy thereof.

The elevated station platforms are being lengthened to take 8-car instead of 5-car trains.

Length of track	222 route miles.
Car-miles, 1907	52,061,569
Revenue passengers, 1907	271,084,815
Traction units, 1907	148,663,993
Departmental lighting	9,522,793
Units per car-mile...	3·05
Percentage of working expenses to receipts	71·25
Receipts per car-mile	13d. (approx.)
Working costs per car-mile	9½d. (approx.)
Average fare	2½d.
Cars in stock	3,426

The 5-cent fare does not allow a reasonable rate of profit.

Working costs increase steadily.

Rails are much worn by street traffic, and there is no remedy.

Both chilled and tired wheels are used, the average life of the former being 31,000 miles, and of the latter from 100,000 to 175,000 miles.

4·7 per cent. of 1907 total receipts was paid as compensation for personal injuries.

Transfer tickets are a source of expense and fraud.

00 (? B. & S.) trolley wire is used, having a life of 1 to 15 years.

Legal. — ANGLO-ARGENTINE TRAMWAYS CO., LTD.—In the Chancery Division on Tuesday, January 12th, before Mr. Justice Swinfen Eady, Mr. Younger, K.C., on behalf of this company, asked for the sanction of the Court to the company's scheme, which contained an arrangement whereby the existing issue of 6 per cent. debenture stock, amounting in capital to a sum of £266,600 should be exchanged for an issue of 4 per cent. debenture stock. The scheme further laid it down that, in the event of such an exchange, the 6 per cent. debenture-holders should receive £155 value for every £100 4 per cent. stock. Counsel explained that the company was incorporated in 1887, and its paid-up share capital amounted to £7,900,000. In August, 1888, it issued the 6 per cent. stock in question, chargeable upon certain specific operations of the company, and payable on June 30th and December 31st each year, and repayable, in the event of liquidation, at the rate of £125 for every £100 worth of stock. They now proposed for every £100 worth of 6 per cent. stock, to issue £155 worth of 4 per cent. stock, redeemable at not less than £102, and carrying interest at 4 per cent. The petition was supported on the grounds that such a change would be to the advantage both of the 6 per cent. debenture-holders and the company generally. His clients, Mr. Younger stated, acquired a tramway company known as the Argentine Central Tramways Co., and by virtue of such acquirement the latter company had secured a charge upon the Anglo-Argentine Co. of £71,000 a year for 80 years. The revenue of the company, however, was enormous. Last year, after the payment of this £71,000, there was a sum of £475,000 left for the payment of interest upon stock. It could not be disputed that the security was ample. At the meeting convened to consider the scheme 103 shareholders, representing £143,000 of the capital, supported the proposal, and 16 persons, holding £18,100, opposed it.—Mr. Gatey, representing two shareholders holding £500 and £1,000 respectively, opposed the petition on the ground that it was not a business-like arrangement, and was not fair to the 6 per cent. debenture-holders.—His Lordship, however, held that the company had made out their case, and granted the petition.

RHODES *v.* SMITH & Co.—This case came before a Divisional Court consisting of the Lord Chief Justice and Mr. Justice Walton on Monday on the plaintiff's appeal from a decision of the Liverpool County Court Judge. The plaintiff, Dr. W. G. Rhodes, an electrical engineer, of Manchester, brought the action against the defendants, a firm of electrical engineers, for the return of certain plans he had prepared, and damages for their detention. His case was that many years ago he prepared several plans of a projected

railway between Llandudno, Colwyn Bay and Rhyl. In 1895 defendants were employed to construct the line, and Mr. F. W. Smith, of the defendant firm, requested the loan from the plaintiff of the plans he had prepared, which the plaintiff did. Afterwards a dispute arose and defendants left the work, and the plaintiff was appointed as electrical engineer to the undertaking *pro tem.* Plaintiff then asked the defendants to return his plans, but defendants said they could not find them. Plaintiff accordingly subsequently commenced the present action. At the trial the County Court Judge held that the property in the plans was not in the plaintiff, and gave judgment for the defendants. Hence the present appeal of the plaintiff. At the conclusion of the arguments of counsel for the appellants, and without calling upon counsel for the respondents, their Lordships dismissed the appeal.

Rowton *v.* Twickenham and Teddington Electric Supply Co., Ltd.—At Brentford Police Court on Tuesday, before a full Bench, the defendants were sued by Frank S. Rowton for penalties for refusing to supply electric current to No. 23, Copthall Gardens, Twickenham. Mr. B. A. Cohen prosecuted and Mr. T. Jones defended.

The case, as set out by Mr. Cohen, showed that under Sec. 27 of the Electric Lighting Clauses Act, 1899, the undertakers, if called upon by the owner of a house situated within 50 yards of a distributing main, shall supply electric current. In default, they were liable to a daily penalty of 40s. The house in question was built by a Mr. Gale, with whom the contractors entered into an agreement to wire and fit it for electric lighting. He leased the premises for 99 years to a Mr. Bradbury, who assigned the lease to Mr. Rowton, who believed he acquired the wires and fittings. In July he applied to the company to supply current, and they replied forwarding a form of contract, one of the heads of which was that he should pay a rental of 5s. a year for the wiring and fittings. As he believed he had bought them absolutely, he declined to agree to the request. The company rejoined that they claimed the wires and fittings. Subsequently, on December 10th, complainant formally served a demand for the current to be laid on, and the company replied that they would not act upon it if he made use of their property. Concluding, counsel asked that heavy penalties should be imposed.

Complainant, having produced his assignment of the lease and borne out the facts, in cross-examination said that Mr. Bradbury, for whom he purchased, told him that the fittings were his own. He had never found a notice on the switchboard to the effect that "the fittings were the property of the Twickenham and Teddington Electric Lighting Co." He had no knowledge that it was the custom of the company to wire houses in Twickenham and charge rent to the occupiers. He did not sign any notice to connect in July; he only called at the offices.

Mr. H. Bradbury, lessor to the complainant, said that whilst he was in possession no demand was made on him for rent of the wires, &c. Cross-examined: He never occupied the house, but sub-let to a Mr. Burl. He did not know if the tenant paid anything.

Mr. A. E. Bullen proved serving in December a demand to connect, addressed by post to the defendants at "Athelstan Road, Twickenham." Cross-examined: He did not know that the registered offices of the company were at Westminster.

Mr. Jones, in defence, said the case was of the utmost importance to electric lighting companies and local authorities which supplied electric light, because it was the almost universal custom of such undertakers to supply fittings and wires to houses on condition that the owners rented or bought them. The defendant company had spent £20,000 on this system of wiring and installing, and all over the country hundreds of thousands of pounds were locked up in this manner. The question at the bottom of the case was, were the fittings and wires the property of the company? If so, they were entitled to rent for them; if not, then they had no such claim. Further, there was the question, did the complainant buy the wires and fittings, even though they were not the property of the lessor? The rule of law was that a purchaser bought everything that was on the freehold, but was it just that on a technicality of that kind, the complainant was to get hold of £10 worth of fittings that were the property of the defendants. He was entitled to meet that technicality by other technical points. First of all, he took the objection that there had been no demand for the current to be supplied in the manner required by the Act, which stated that it must, except in the case of a local authority, be served at the registered offices of the undertakers, and must contain certain specified particulars. The notice of July was a mere verbal one and of no account, and the written one of December was sent to the works at Twickenham, whereas the registered offices were at Westminster. Moreover, in neither case were the requisite specified particulars given. Another point was that no contract existed between the complainant and the company, and without it the company could not recover for the current or the cost of the fittings. Under Hussey *v.* the London Electric Supply Corporation, heard in the Court of Appeal, it was laid down that until a contract was entered into, no supply could be insisted upon. These fittings in question were installed in the house by a Mr. Burl, the tenant of the assignee to the complainant, and the complainant took them over, subject to the obligations resting on the previous tenant. Mr. Bradbury never had or possessed the fittings, and, therefore, how could he assign them? Under the Act (Sec. 27, Sub.-Sec. 1) the company were entitled to ask for payment of the fittings before they connected the service.

Mr. F. C. Lovett, an employé of the defendant company, deposed that the house was wired and fitted under contract with Mr. Burl, who made rental payments for them. Mr. Gale, the builder of the house, assented to the agreement between Mr. Burl and the company.

The Chairman: And I see he agreed in the event of a sale of the premises, to inform the new owner of the conditions under which the fittings were there?—That is the kernel of the case.

Mr. Cohen argued that the question of ownership of the property did not arise, and could not, in that Court.

The Chairman said the Court were of opinion that the case must fail on the ground that the notice to connect was not properly served on the defendant.

On the application of Mr. Cohen they agreed to state a case.

Flame Arcs.—To the ordinary buyer who is perplexed with rival claims, it may seem that before the introduction of anything fresh, the field should be cleared to some extent by the elimination of the weaker designs at present existing. The difficulty that confronts a man who has an arc lamp scheme to arrange, and who has to decide which make of flame arc to adopt, is serious, inasmuch as the problem cannot be reduced to anything like simple terms of comparison of price.

One of the great drawbacks to the extended use of flame arc lamps is that their short period of 16 or 18 hours' burning renders recarboning at frequent intervals a necessity. Where this is entrusted to a shop assistant there is some danger of damage to the lamps either through ignorance or forgetfulness, and the great advantage of a flame arc as an advertising medium outside a shop is frequently lost through circumstances which cannot always be placed to the blame of the manufacturers. Under these circumstances there was every reason for the introduction of magazine flame arcs or multiple arcs. Various examples of these types of lamps have been installed for street and shop lighting, and undoubtedly mark an advance.

At the same time, certain disadvantages have been noted which to a certain extent interfere with the usefulness of the 34-hour lamps. Taking, for example, the magazine type, which burns up short lengths of carbon, and, when the rods have become too short, automatically ejects them and brings new carbons into operation, it is found that such carbon changing must certainly interfere with the even burning of the lamps in the same circuit when these are in series. The low voltage at which flame arcs burn renders this series arrangement necessary for most cases of shop lighting, and certainly in street lighting. This means that from time to time a jump or flicker occurs on all the lamps in that series due to the change of carbons in one magazine, an effect which, although it may be tolerated for street lighting, is not at all pleasant for shop use.

Taking the alternative method, in which four carbons point towards the same inverted apex, around which the arc wanders from electrode to electrode as the rods get burned away, it is evident that this very changing from one rod to another, which is claimed as a good point by the makers of such lamps, leads to a continual variation in the voltage of the arc, and consequent variation in candle-power which it is impossible to overcome. Here, again, this effect is particularly noticeable when such lamps are burning in series.

If long-hour flame arc lamps are to become settled institutions, it would, therefore, seem requisite that the arc shall be interrupted through carbon changing as seldom as possible during the hours of burning. Any multiplication of this leads to irregular action on the part of the lamps when in series, and were it not for the inordinate length which a 34-hour single-pair lamp would attain to accommodate the carbons necessary, even one break in burning would be better done away with. As a matter of fact, there is not at present, so far as we are aware, any flame arc lamp on the market that will feed for 34 hours with only one break.

There is, however, another side to the question. Long hours of burning would be all very well if there were no fumes; but everybody knows that the flame arc lamp occasions a deposit which, if it does nothing else, obscures the globe and dims the light thrown on to the window or street. The ordinary shop assistant is not going to clean his arc lamp till it is time to re-carbon it, and it may almost be said that having regard to human nature the 34-hour lamp exceeds its period of usefulness. There is, indeed, serious danger that continual neglect to clean the lamp over such long periods may lead to rapid deterioration of the working parts.

Flame arc manufacturers should devote their attention to devices whereby the vertical length of the lamp may be reduced, as, up to the present, many of the lamps on the market, owing to the anxiety of their manufacturers to produce long hours of burning, have got to such a size that an ordinary bracket over a shop window will not lift the lamps high enough to be reasonably clear of the heads of passers-by.

Furnace Gases for Electric Lighting.—A Lubeck correspondent states that negotiations are proceeding between the owners of the Lubeck blast furnaces and a leading electrical firm, with a view to the profitable utilisation of the furnace gases at this works. The name of the Siemens-Schuckert Works is mentioned in this connection, and the scheme provides for the erection of a central station for using the gas for power purposes. At present preliminary steps are in progress to ascertain the lighting requirements of the local authorities in the State of Lubeck, Holstein and the Grand Duchy of Mecklenburg-Schwerin, &c. This seems to be rather a large order, seeing that the blast furnaces are only two in number.

Staff Dance.—The members and friends of the General Electric Co., Ltd. (Glasgow branch), held an enjoyable staff dance in the Prince of Wales's Hall, last Friday evening. The March was led off by Mr. H. W. Warde (the manager) and Mrs. Warde. Mr. D. Sinclair, A.M.I.E.E., acted as M.C. Songs were rendered during the evening by Miss A. Smitton and Mr. A. Shaw. Mr. Q. Henderson replied for "The Visitors."

Electrical Progress in Lancashire.—In the *Manchester Evening News* for January 6th, there appears an interesting article on "Electrical Progress in Lancashire: A Fine Record," in the opening parts of which "T. H.," the writer, says:—"The industrial cloud which was the predominating feature of the year just closed in this shire hardly in any degree affected the electrical field of operations. It is, on the contrary, safe to assume that the aggregate advance in all the realms of electrical usage was nearly equal to that of the two previous years put together. Before the Electrical Exhibition (in October) came to greatly stimulate the question of electrics, there had been manifested in every direction an interest in its practice which was but the result of years of educational effort on the part of those who are at the head of our great electrical stations, and the exhibition came in as the last convincing word to push Lancashire on the high plane occupied by America and one or two of our Continental neighbours. This onward march is not confined to any division of the county; it is observable in the great cities and towns as well as in the multitude of urban districts. From no quarter come reports of retrogression. Of course, there are many municipal plants working at a loss, but this is often found to be owing to the original diminutiveness of the generating unit. There are others, like Liverpool and Manchester, where the enormous capacity of the electrical machines leads to elaborate systems and immense profits, which go to the reduction of the rates. But the general awakening has been among power users. Since last January hundreds of mills, foundries, bleach works, sawmills, and thousands of the auxiliary trades have become wholly or partially put to electrical power practice, with the result that each installation is the certain forerunner of another, and most often a greater. Corporations and urban district councils on every hand are seeking to enlarge their stations, and large firms with their own generating sets are loading to the maximum capacity and preparing for more. Districts without a supply are pressing for the operation of provisional orders, to meet which the only power company in the county (the Lancashire Electric) is now strenuously extending its mains north, then west, and south."

Electric Shock Fatality.—The death of W. J. Reader, a labourer, while engaged in painting the interior of a boiler at Lot's Road generating station, was further inquired into at Chelsea Town Hall on 10th inst. Deceased was found dead with a broken electric lamp-holder by his side. Mr. J. W. Towle, the resident engineer, said that a large hole had been burnt in the side of the lamp-holder cap. He had never been told that Reader's lamp was defective. Sufficient precautions had been taken with regard to ventilation. In the course of the inquiry, Mr. J. B. Dampney, of Cardiff, said that the "apexior" paint contained a volatile spirit of the nature of naphtha or benzine, but it was not an explosive. In the ordinary circumstances, a naked light could be used, but he would not advise it. A weak man might be overcome by the fumes, but he had never known such a case. Mr. G. Scott Ram, electrical inspector for the Home Office, said that the lamp was neither better nor worse than those generally in use. There had been previous fatal accidents through the use of such lamps, and manufacturers were trying to improve on them. When standing in an iron boiler it was dangerous to use them. If the lamp was perfect it would be safe, but it should not be used in such places without further precautions. As to the voltage of the lamp, he must regard it as dangerous in the circumstances, as within the last six years he had known 22 persons killed by shocks at 250 volts or less. In his opinion the defects in the lamp were old.

The medical evidence showed that death was due to an electric shock.

The jury returned a verdict of accidental death from electric shock due to a fall, the cause of which they were unable to determine. The jury added that they considered the electric lamps were insufficiently protected for such work, and that men working under such conditions should be frequently visited.

Reported Discovery of Tantalum.—It is reported that a discovery of tantalite has been made in the vicinity of Swakop, not far from Swakopmund, German South-West Africa. Hitherto America and Norway have formed the principal sources of supply, and the Siemens & Halske Co. is said to have practically monopolised the consumption in the production of tantalum lamps.

Electrical Production of Steel in Norway and Russia.—According to a report furnished by the German Consul at Christiansund, an experimental plant for the electrical production of steel, has recently been started in the vicinity of Flekkefjord, the motive power being obtained from an adjoining waterfall. The process used is that devised by the Norwegian engineer, Hjorth, and the product made is best tool steel, although a future extension contemplates the manufacture of plates. Pig and other iron is obtained from Norway, and is smelted by electricity and converted into steel. It is stated that the capital for the enterprise has principally been raised in Holland.

A plant for the electrical production of steel by the Herault process has lately been installed at the Obonthoff Steel Works, St. Petersburg.

Copper.—The copper market has a slightly easier tone, and deliveries are at a higher figure. Visible supplies continue to increase, reaching on December 31st, 1908, the figure 55,677 tons, according to Messrs. Merton's circular. The increase is principally in stocks at Liverpool, Swansea and French ports, and in fine copper afloat from Australia (700 tons more than for November 30th). Chile shipments are 4,800 tons, and North American slightly increased.

Superheating.—Mr. S. M. Vauclain, of the Baldwin Works, recently championed the use of low superheat before a meeting of the Master Mechanics' Association. He said he felt that highly superheated steam was not what they wanted in America, but that they wanted it superheated sufficiently to overcome all the loss of a single expansion engine, and, at the same time, to go back to a normal boiler pressure of 160 lb. per sq. in. He wants to build simple, rather than compound, engines, and his experience proves that he can obtain the same economy from a low superheated steam at 160 lb., as with compound locos. carrying 220 lb., and in addition he can get from 30 per cent. to 50 per cent. more engine miles in a given time. In order to get the very best results from superheat, very large cylinders must be used in proportion to the weight on the drivers, so that a greater number of expansions can be obtained than is usually considered desirable in simple engines.

In Germany, owing to the influence of Herr Schmidt, highly superheated steam (100° to 150° F.) is advocated, and certain speakers at the Master Mechanics' Association strongly held the same view.

We should like definite reasons from Mr. Vauclain for wishing to get a large number of expansions out of one big cylinder rather than the same number, or even more out of compound cylinders?

One of the speakers asked whether anyone had observed a gradual change in the dimensions of iron castings which are exposed to superheat, and stated that the fittings in certain power houses have increased as much as 3 per cent. in size. We do not remember to have heard of that phenomenon in England, and we are sure that our readers would be interested to hear from anyone who has made similar observations, especially if research has been made to elucidate the matter. It is not a question of temporary expansion, but of permanant growth.

Football Notes.—ELECTRICAL FOOTBALL LEAGUE.—The matches in this League for Saturday next are as follows:—St. James Electric *v.* Metropolitan Electric, at Wormholt Farm St. Pancras Electric *v.* Robertson's Lamps, at Swain's Lane, Highgate. The kick-off in each case is fixed for 2.30 p.m.

A match was played on Thursday, January 7th inst., on Peckham Rye, between the L.C.C. Sub-stations F.C. (Southern Division) and the Turf Club, Piccadilly, and the result was:—L.C.C. Sub-stations 5; Turf Club, 1.

A well contested game was witnessed on the 6th inst. at Salford, between the South Lancashire and Salford Tramways teams, the result reading: South Lancashire 3 points, Salford 2.

Memorial to Sir George Livesey.—With reference to the steps it has been decided to take to perpetuate the memory of the late Sir George Livesey, the Committee having the matter in hand announce that contributions to the fund should be sent to the Secretary of the Institution of Gas Engineers, 39, Victoria Street, Westminster. A sum of at least £10,000 is required for the object in view—the endowment of a Livesey Professorship in Gas Engineering and Fuel at the Leeds University—and contributions, both small and large, will be welcomed.

Concrete Aggregates.—The Special Commission appointed by the British Fire Prevention Committee to report upon concrete aggregates, has issued an interim report, in which the institution of tests extending over a period of years is recommended. In the meantime, a schedule has been drafted embodying provisional specifications for concrete aggregates employing coke breeze, clinker, slag, broken brick, burnt clay, &c., besides natural ballast and rock of various descriptions.

Institution and Lecture Notes. — BIRMINGHAM ENGINEERING SOCIETY.—Mr. E. E. Baguley, of the B.S.A. Co., Ltd., in an address on "Motor-'Buses," delivered on the 8th inst., said that electrically-driven 'buses were undoubtedly the ideal ones, but at present their cost of running and maintenance was too great and the dead load was more than that of internal-combustion or steam types. He was aware that there was a company running a service of electric 'buses in London, and quite recently they had been inviting the public to subscribe more capital, although they were unable to show by their balance-sheet that they were covering expenses. The company's only inducement was that, with a greater number of 'buses, the working expenses would be the same, but he was afraid the company would find that, in proportion to their responsibilities, so would their expenses be. Electric 'buses were at present very limited and quite impossible in country districts. The Manchester Corporation were at present contemplating a system of motor-'buses worked by overhead trolley wires, but he was very doubtful if it was a system that would appeal to many people.

ROYAL SOCIETY.—Among the papers to be read yesterday afternoon were the following:—

J. A. Crowther, "On the Passage of Röntgen Rays through Gases and Vapours." Communicated by Prof. Sir J. J. Thomson, F.R.S.

E. D. Kleeman, "On the Velocity of the Cathode Rays ejected by Substances exposed to the γ-Rays of Radium." Communicated by Prof. Sir J. J. Thomson, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS (LEEDS LOCAL SECTION).—A dinner will be held on Friday, February 19th. Tickets may be had from Mr. H. Dickinson, hon. sec., Corporation Electricity Works, Whitehall Road, Leeds.

A meeting will be held at the University, Leeds, on January 27th, when a paper will be read by Mr. Stanley Clegg on "G.B. Surface Contact System."

On Monday evening last, Mr. Banister Fletcher commenced a course of 12 lectures on the "Renaissance Architecture of Germany, Belgium and Holland, Spain and England" at the London University, Imperial Institute Road, South Kensington, S.W.

Iron and Steel Institute.—We have received from Mr. G. C. Lloyd, the new secretary of this Institute, particulars of the Andrew Carnegie Research Scholarship, by means of which it is proposed to enable students who have passed through a college curriculum, or have been trained in industrial establishments, to conduct researches in the metallurgy of iron and steel and allied subjects.

Liverpool and District Electrical Association.—The first meeting of the new year was held on Tuesday, January 5th, when a paper was read by Mr. A. Weatherilt, of St. Helens, entitled "Central Stations and Gas Engines." The paper dealt chiefly with the cheap production of power by gas producer plants, and favoured the use of such plants and engines for central generating works, as against steam reciprocating engines and steam turbines, and quoted various comparative figures. Considerable discussion followed.

Institution of Civil Engineers.—At last Tuesday evening's meeting a paper on "High Speed on Railway Curves," was read by Mr. J. W. Spiller, and one on "A Practical Method for the Improvement of Existing Railway Curves," by Mr. W. H. Shortt.

Manchester Association of Engineers.—On Saturday last Mr. W. A. Barnes read an interesting paper on "Metallic-Filament Lamps."

The Institution of Civil Engineers (Students' Meeting).—At the meeting on Friday last Mr. K. W. S. Mitchell read a paper on "Portland Cement: the Effect of Fineness with Aeration on its Strength." An interesting point brought out by the paper was the large increase in surface area covered by a fixed quantity of finely-ground cement over that covered by a like quantity of coarsely-ground cement, thus enabling a larger amount of aggregate to be covered by the finely-ground product. A good discussion followed.

Institution of Electrical Engineers (Dublin).—On Thursday a note on "A Method of Measuring A.C. Currents and Pressure with Considerable Accuracy" was read by Mr. W. Tatlow; and a note on "Shop-Window Lighting" by Mr. N. Horgood.

Electricity in Horticulture.—Mr. J. H. Priestley, lecturer in botany to University College, Bristol, has been applying electricity to the growth of plants. The experiments proved that there was a great acceleration of the crops in the electrified area compared with the other; in fact, on the first pickings, there was 40 per cent. more gathered from the former, than from the unelectrified area. The last strawberry season was a dry one, and it is only fair to state that the application of electricity tends to increase the dryness. Hence, having regard to the total yield, there was a slight falling-off (9 per cent.) on the electrified, compared with the unelectrified area; however, the strawberries grown under the influence of electricity were very much sweeter than the others. This was evident to the taste, and the analysis proved that they contained nearly twice as much sugar. Acceleration of crops is an important advantage due to the application of electricity. Thus, with regard to tomatoes grown out of doors, the difference was extraordinary, the advanced ripening of those grown on the electrified plots being most marked. Further, a large proportion "set" properly, and there was a uniformly better swelling of the fruit. When stored away, the unelectrified fared the worse. The yield of the electrified was 30 per cent. better than of the others, and in the earlier stages it looked as if they would come out 40 or 50 per cent. better, because the plant yielded more rapidly in the electrified area. The thrashing of the wheat has also shown that the system adopted has been very beneficial. An electrified area of 7·675 acres yielded 32·5 bushels per acre, while an unelectrified area of 10·2 acres yielded 26·15 bushels per acre. Considering that the current was not applied until May 17th, the increase, due chiefly to the better filling-out of the ears and plumper grain, was most satisfactory. The current was applied too late to affect the number of ears. For the first time, some experiments were carried out at Bitton, the system being applied here to greenhouses, as well as to plots in the open. The houses were chiefly devoted to cucumbers. The plants in the houses where the apparatus had been fixed bore much earlier than the others, so that at the end of the first month twice as many had been picked from the one as from the other. The acceleration, moreover, did not seem to exhaust the plants, for not only did they bear earlier, but also much later than those grown under normal conditions.

Appointments Vacant.—A Professor of Physics is to be appointed by the Council of Victoria University College, Wellington, at £600 per annum, on a five years' engagement, duties commencing from July 1st, 1909; the Hackney Borough Council is inviting applications for the post (rendered vacant by the resignation of Mr. Dyson) of electrical draughtsman at a commencing salary of £150 per annum. Manager for the Douglas Southern Electric Tramways, Ltd. (£200); see "Official Notices" to-day.

Concert.—Last Saturday week the B.T.-H. Athletic Club held a smoking concert at Rugby, about 50 gentlemen being present. Mr. A. Allcutt presided.

Robertson Social and Athletic Club.—On Saturday last the above club in connection with Robertson Electric Lamps, Ltd., held their third annual Fancy Dress Dance at Brook Green Works, Hammersmith, in the spacious hall, which had been prettily decorated for the occasion. The attendance numbered 2 wards of 350, and among those present were:—Mr. and Mrs. C. Wilson, Mr. and Mrs. H. Bevis, Mr. Driver, Dr. and Mrs. Levy, Mr. and Mrs. Hellyar, Mr. and Miss Bendon, and Mrs. Wright. Mr. F. Pluck and Mr. F. Goulden ably performed the duties of M.C.'s, and Mr. S. J. Richards's Scarlet Bohemian Band provided excellent music. There were a large and varied number of fancy costumes, and the prizes were presented by Mrs. C. Wilson. The dancing terminated at 12 o'clock after a most enjoyable evening. The whole of the arrangements were successfully carried out under the direction of the secretary, Mr. G. H. Freeman, and the Committee.

The Cause of Rust.—The generally and long-accepted notion about rust is that it is caused by the contact of iron with water and air, and that it results from simple oxidation. There are always a few people who do not believe a statement simply because it is backed by the authority of age, and within the last few years the above theory has been displaced by one after another, all built upon and all demolished by experiment, until there has sprung up and survived the theory that the rusting of iron is primarily due to the attack of acid.

At the time when bacteria were in everyone's mouth, a hardy form was discovered and given the poetic name of *Gallionella Ferruginea*, which "obtains its life energy by the decomposition of organic ferrous salts with the precipitation of rust." Certain biologists thereupon framed the theory that rust was attributable to bacterial agency. Mr. J. Newton Friend, who presented a paper to the Iron and Steel Institute in May, proved, however, that iron would rust as readily in carefully sterilised tubes as in the open air. Then a strong school arose teaching that rusting was the outcome of electrolysis, but Mr. Friend demolished this idea on the ground that CO_2 was present in the tests, but had been ignored.

Mr. Calvert first suggested that the presence of acid traces in water causes the solution of the iron in the form of a ferrous salt, which absorbs oxygen. Rust is precipitated, and the acid freed to start again.

Mr. Friend, improving on experiments by Mr. Moody, proved that pure iron can be kept for an indefinite time in the presence of pure water and air without change, but that the introduction of the merest trace of acid causes immediate corrosion.

Cast-iron, on the other hand, rapidly rusted without acid, owing to the catalytic or electrolytic action of its impurities.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. L. A. Gomersal, of Hemsworth, has been appointed engineer-in-charge to the Coatbridge and Airdrie Electric Supply Co.

A newspaper report from Johannesburg says that Prof. Dobson, of the University College, Johannesburg, at a meeting of the T.C. held on December 18th, was appointed general electrical engineer, at a salary of £1,250 per annum, with £100 "locomotion allowance." Prof. J. H. Dobson was trained in Crewe Railway works. He gained the Cheshire County Council scholarship, the Sir Richard Moon scholarship, tenable at Liverpool University, the Whitworth Exhibition, tenable at Manchester, and many degrees and diplomas. When the Transvaal University was opened, he was appointed to the professorship of electrical engineering.

The Rawtenstall Electricity and Tramways Committee has received 137 applications for the post of electrical and tramway engineer for the borough. The list has been reduced to four, who will be invited to an interview with the Committee. The salary is £200 per annum.

On Christmas Day at the power house, Wari Bunder, Bombay, Mr. J. A. B. Colombi, assistant engineer, was presented with a handsome case of fish and fruit knives and forks, carvers, &c., in a polished oak case, by the officials of the Brush Electrical Engineering Co., Ltd., on the occasion of his marriage with Dorothy Mary Fuller, stepdaughter of Mr. Wm. Marsden-Hind, chief engineer of the station.

Mr. K. A. E. Bashell, chief correspondence clerk, West Ham electricity undertaking, is to have his salary raised from £125 to £140 per annum, with a further increase to £150 at the expiration of 12 months.

Tramway Officials.—Warrington T.C. has adopted the recommendation of the Tramways and Electricity Committee to increase the salary of Mr. John Telfer, tramways manager, from £175 to £208 per annum.

The Rochdale T.C. has confirmed the recommendation of the Tramways Committee to advance the salary of the tramways manager, Mr. Moffet, from £300 to £350, with two further yearly increases of £25, bringing the salary up to a maximum of £400.

The salary of Mr. Pringle, the manager of the Burton-on-Trent Corporation tramways, has been increased by £25 per annum.

General.—The staff of the National Telephone Co. at Swansea have presented a marble clock and bronze ornaments to Mr. H. G. McArthur, contract manager, on his marriage.

Mr. G. H. J. Hooghwinkel has taken into partnership Mr. Wm. Anthony Brown, A.M.Inst.C.E., F.R.G.S., and the style of the firm

will be HOOGHWINKEL, ANTHONY BROWN & PARTNERS, consulting engineers, with offices at 24, Martin's Lane, Cannon Street, E.C. Mr. Brown will more especially devote himself to the design and construction of railways, whilst Mr. Hooghwinkel will continue his practice in connection with electric lighting, power and traction, colliery installations, &c.

We understand that MR. ALGERNON GASCOIGNE RUTTER, for many years associated with the Silvertown Co.'s submarine electrical department, has accepted a superior technical appointment at Cienfuegos, head office in Cuba of the Cuba Submarine Telegraph Co. Mr. Rutter has done good work on all the ships of the Silvertown Co., but he has for some years past been chiefly identified with the cable repair ship *Buccaneer*, on which he was chief electrician. Mr. Rutter's departure is keenly regretted by his many friends, who wish him all prosperity in his new sphere of action. Before Mr. Rutter's departure for Cuba, his friends in the Silvertown Co. presented him with a chronograph stop-watch as a small token of great regard.

NEW COMPANIES REGISTERED.

Dumfries Electricity Supply Co., Ltd. (6,990).—This company was registered in Edinburgh on January 7th, with a capital of £40,000 in £1 shares, to acquire and work the undertaking authorised by the Dumfries Electric Supply Order, to adopt an agreement of sale with the India-Rubber, Gutta-Percha and Telegraph Works Co., to construct, repair and maintain dynamos, accumulators, cables, wires, apparatus, lamps and works, and to carry on the business of generators and suppliers of electricity, electrical and mechanical engineers, &c. The subscribers (with one share each) are:—W. E. Gray, 8, Moidan Road, Blackheath, London, civil engineer; R. N. Moir, 5, Lyncroft Gardens, Hampstead, London, secretary to public company; S. A. Russell, 22, Coventry Road, Ilford, Essex, civil engineer; E. C. Danberry, 40, Edwards Square, Kensington, London, civil engineer; Talfourd Ely, Golden Hill Cottage, Hampstead, London, electrical engineer; S. E. Marsham, 22, Chester Square, London, gentleman; A. P. Crouch, Station Road, Chorley Wood, Herts, electrical engineer. The first directors are W. E. Gray, R. N. Moir and S. A. Russell. Registered office, Leafield Road, Dumfries.

Consolidated Electric Works and Appliances, Ltd. (101,022).—This company was registered on January 7th, with a capital of £5,000 in £1 shares, to adopt an agreement with W. Murch, and to carry on the business of electrical engineers, electricians, suppliers of electricity, manufacturers of electrical apparatus, &c. The subscribers (with one share each) are:—T. Ward, 7, Northampton Grove, Canonbury, N., clerk; W. Murch, 31, Avington Grove, Penge, S.E., engineer. Private company. The number of directors is not to be less than two or more than seven; the first are T. Ward and W. Murch; qualification (except first directors) 100 shares; remuneration (except managing director) one guinea each per board meeting attended. Registered by C. Doubble, 14, Serjeants Inn, E.C.

Northern Aluminium Co., Ltd. (100,980).—This company was registered on January 4th, with a capital of £1,000 in £1 shares, to carry on any business relating to the winning and working of aluminium, sodium or iron, and the production, manufacture, preparation and treatment of such metals, &c. The subscribers (with one share each) are:—H. S. Sugden, 10, Ironmonger Lane, E.C., solicitor; E. C. Darling, Caxton House, Victoria Street, Westminster, manufacturer; R. W. Taylor, Caxton House, Victoria Street, Westminster, clerk. Private company. The number of directors is not to be less than two or more than five; the first are not named. Registered office, Caxton House, Victoria Street, Westminster.

Cape Town-Cairo Railway and Telegraph Combination Syndicate, Ltd. (101,005).—This company was registered on January 6th, with a capital of £20,000 in £100 shares, with objects as indicated by the title. The subscribers are:—F. Gheel Gildemeester, 4, Park Place, St. James', S.W., merchant, 70 shares; F. R. Wilm, 200, Holland Road, Holland Park, W., 1 share. Private company. The number of directors is not to be less than two or more than five; the first are F. Gheel Gildemeester, F. R. Wilm and R. Poeppel; qualification, £100; remuneration of chairman, 50 guineas per annum; of other directors as fixed by the company. Registered office, Broad Street House, New Broad Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rangoon Electric Tramway and Supply Co., Ltd. (86,932).—Trust deed dated December 22nd, 1908, to secure £100,000 debenture stock (supplemental to a trust deed dated February 1st, 1906, securing £150,000 debenture stock). Property charged: The company's undertaking and property, present and future, including uncalled capital. Trustees: Sir John G. Hill, Kt., 10, Water Street, Liverpool; and R. Henderson, 17, Water Street, Liverpool.

Harrow Electric Light and Power Co., Ltd. (44,529).—Particulars of £25,000 debentures created January 1st, 1909, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. Property charged: General assets (subject to existing mortgage). No trustees.

Kinetic-Swanton Co., Ltd. (London and Lincoln) (78,688).—Particulars of £500 debentures created December 31st, 1908, filed pursuant to Sec. 10 (3) of the Companies' Act, 1907, the whole amount being now issued. Property charged: Company's general assets. No trustees.

City and South London Railway Co.—After providing for the debenture stock interest, the directors recommend payment of the dividend on the 5 per cent. preference stocks 1891, 1896, 1901 and 1903, the transfer to the renewal fund of £1,500, and a dividend on the consolidated ordinary stock at the rate of 1¼ per cent. per annum, carrying forward £954. Last year the interim dividend was at the rate of 1¼ per cent. per annum.

CITY NOTES.

South Metropolitan Electric Light and Power Co., Ltd.

A CIRCULAR has been issued by the secretary calling an extraordinary general meeting for January 15th (to-day) at Winchester House, E.C., at which resolutions will be submitted, increasing the capital to £500,000, by the creation of 20,000 new ordinary shares of £5 each, to rank rateably with the existing ordinary shares, and 20,000 second preference shares of £5 each bearing interest at 6 per cent. per annum after 7 per cent. has been paid on the first preference shares. It is further proposed to consolidate the first preference shares, and the existing ordinary shares, so that every five £1 shares shall constitute one £5 share, for which purpose the existing certificates will be called in and cancelled. The voting power will be unaffected.

From the last documents and returns issued by the company, we find that £120,000 ordinary, and £142,968 preference (7 per cent.) shares have been issued totalling £262,968. In April last, debenture stock (4½ per cent.) had been issued to the tune of £266,000. Doubtless at to-day's meeting the chairman will explain for what purposes the new capital is needed, and when it will be issued. The ordinary shares already subscribed stand below par, and the preference shares at a premium, as a reference to the following "Stocks and Shares" pages will show.

Paris Compressed Air Co.—The report for 1907-8 of the Compagnie Parisienne de l'Air Comprimé, of Paris, states that the receipts from the electric supply department amounted to £153,500, as compared with £232,800 in the previous year, and those from the compressed air branch were £38,800, as against £34,000 in 1906-7; the reduction in the former being attributed to the lower prices associated with the new concession. It has been decided to devote £60,000 to the special account for the redemption of the installations, this contrasting with £160,000 appropriated for the same purpose in 1906-7. The net profits total £101,600, as compared with £97,700 in the preceding year; and a dividend has been declared at the rate of 34·78 fr. on the ordinary shares, as against 32·50 fr., and 25·96 fr. on the profit shares, as contrasted with 21·30 fr. in 1906-7. The directors express the hope that during the remaining five years of the period of transition it will be possible to provide sufficient for redemption, so as to fully write off the balance of cost of installation before the expiration of the compressed air concession.

Stock Exchange Notices.—The Committee has ordered the following to be quoted in the Official List:—

British Columbia Electric Railway Co., Ltd.—Further issue of £100,000 deferred ordinary stock.

Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

United Electric Tramways of Monte Video, Ltd.—Further issue of 6,500 6 per cent. cumulative preference shares of £5 each, fully paid; and £200,000 5 per cent. first debenture stock.

And to allow the following securities to be quoted in the Official List:—

Bournemouth and Poole Electricity Supply Co., Ltd.—Further issue of £37,500 4½ per cent. debenture stock.

Commercial Cable Co.—Further issue of £47,974 sterling 500-year 4 per cent. debenture stock.

Metropolitan Electric Tramways, Ltd.—Further issue of £76,200 4½ per cent. debenture stock.

Western Union Telegraph Co.—In estimating their position as at December 31st last, the directors place the surplus and revenue for quarter ended September 30th, 1908, at $16,258,811, which, after providing for interest charges and dividend, leaves a surplus of $15,327,928. The estimated net earnings for the quarter ended December 31st are put at $1,566,937, and after paying interest and dividends the estimated surplus at December 31st is $16,148,043.

Direct United States Cable Co., Ltd.—An interim dividend of 4s. per share, free of income-tax, being at the rate of 4 per cent. per annum, for the quarter ending December 31st, 1908, is proposed payable on and after 30th inst. £5,000 is set aside to the reserve fund account, carrying forward about £4,500. The transfer books will be closed from January 12th to 26th both days inclusive.

Chili Telephone Co., Ltd.—The directors have declared an interim dividend of 3s. per share, free of income-tax for the past half-year.

Dublin United Tramways Co. (1896), Ltd.—The directors recommend a dividend of 6 per cent. per annum (6s. per share), free of income-tax, on the ordinary shares for the past half-year. According to the *Financial Times*, £13,251 is charged for relaying the line to Blackrock, and £8,149 is proposed to be carried forward.

Germany.—The Telephonfabrik Gesellschaft (Berliner), of Hanover, is declaring a dividend of 10 per cent. for the last financial year.

Bank Rate.—The Bank rate was yesterday raised to 3 per cent.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Route miles open. Inc.
Aberdeen	Jan. 6	2,682	— 172	32	45,577	— 237	14·4	..
Ayr	,, 9	405	+ 12	34	10,869	— 247	8	..
Bath	,, 6	1,284	— 62	52	38,979	— 2,259	13	..
Belfast	,, 8	7,169	+ 632	41	149,767	— 97	37	..
Birkenhead	,, 10	2,018	+ 55	41	43,820	+ 448	13·52	..
Birmingham Corp.	,, 2	13,489	+ 394	40	255,062	+ 7,021	56·46	..
Blackpool-Fleetw'd	,, 9	490	+ 85	52	21,604	— 1,617	8·25	..
Bolton	,, 10	4,716	+ 258	41	95,110	+ 1,448	26	..
Bournemouth	,, 6	2,728	— 9	40	66,968	— 3,275	21·72	..
Bradford	,, 2	9,223	— 149	39	186,430	+ 51	54·9	..
Brighton	,, 10	1,337	+ 35	40	38,118	+ 840	9·5	..
Bristol	,, 8	10,154	+1,113	..	..	..	31	..
Brit. Elec. Trac. Co.								
Airdrie	Jan. 1	453	— 90	52	11,578	— 156	3·65	..
Barnsley	,, 1	401	+ 13	,,	9,241	+ 462	..	..
Barrow	,, 1	425	— 42	,,	12,604	— 698	5·37	..
Cavehill	,, 1	126	— 5	,,	4,465	+ 189	..	..
Devonport	,, 1	1,113	+ 72	,,	24,376	+ 486	8·85	..
Gateshead	,, 1	2,269	— 15	,,	52,763	— 94	11·25	..
Gravesend	,, 1	315	— 63	,,	10,904	— 1,790	6·5	..
Greenock	,, 1	891	— 212	,,	27,041	— 6,376	7·25	..
Hartlepool	,, 1	463	— 88	,,	12,332	— 2,638	6·72	..
Kidderminster	,, 1	217	— 18	,,	5,716	— 459	..	..
Leamington	,, 1	306	+ 56	,,	8,904	+ 598	3	..
Merthyr	,, 1	475	— 29	,,	11,186	+ 28	2·9	..
Metropolitan	,, 1	11,503	+ 881	,,	299,802	+55,602	22	..
Middleton	,, 1	621	— 39	,,	18,265	+ 3	8·5	..
Mid. Joint Com'tee	,, 1	12,456	— 1 3	,,	300,138	— 6,264	..	..
Oldham—Ashton	,, 1	1.107	— 88	,,	31,876	— 919	9·13	..
Peterborough	,, 1	252	— 31	,,	6,582	— 59	5·31	..
Potteries	,, 1	3 689	— 383	,,	94,466	— 2,951	29	..
Rothesay	,, 1	102	— 19	,,	9,915	— 615	2·75	..
Southport	,, 1	388	+ 11	,,	15,244	— 621	8·17	..
S. Metropolitan	,, 1	1,519	— 34	,,	41,942	+ 528	..	..
Swansea	,, 1	1,984	+ 81	,,	49,248	+ 1,261	12·5	..
Tynemouth	,, 1	254	— 95	,,	11,689	— 839	3·75	..
Weston-s-Mare	Dec. 30	49	— 2	,,	6,822	— 280	3	..
‡Worcester	Jan. 1	530	+ 9	,,	14,560	— 63	5·75	..
Wrexham	,, 1	212	— 12	,,	5,941	+ 2	..	..
Yorks. Wool. Dist.	,, 1	1,950	— 44	,,	47,628	— 850	17	..
Miscellaneous	,, 1	389	— 66	,,	10,620	— 951	..	..
Burnley	Jan. 9	2,195	— 188	..	..	..	7·5	..
Burton-on-Trent	,, 10	620	+ 88	41	11,097	— 601	10	..
Bury	,, 10	2,060	— 121	40½	47,545	+ 1,708	22·5	..
†Cardiff	,, 9	2,007	+ 113	31	88,568	+ 166	..	..
†Carlisle	,, 2	154	— 1	52	9,210	— 34	..	..
Chatham and Dist.	,, 7	1,407	+ 222	52	40,931	+ 3,299	14·98	2·82
Cork	,, 7	870	+ 118	52	24,240	— 195	9·89	..
Croydon	,, 1	2,715	+ 25	40	56,488	— 569	11·25	·75
Darlington	,, 9	375	— 30	41	8,071	— 666	..	..
Darwen	,, 8	464	+ 6	40	10,196	— 287	4·36	..
Dover	,, 2	316	— 23	40	8,806	— 407	4·75	..
Dublin	,, 8	9,466	+ 679	..	..	..	54·25	5·5
Dundee	Dec. 30	1,125	— 211	32½	39,493	+ 1,791	14·5	..
East Ham	Jan. 9	1,789	+ 72	41	36,206	— 961	8·43	·68
†Exeter	,, 8	765	+ 131	41	13,016	+ 257	5·5	..
Glasgow	,, 9	35,490	+ 426	..	549,751	— 9,585	90·5	1·5
Hastings	,, 7	1,407	— 6	..	..	..	..	..
†Huddersfield	,, 2	1,516	+ 117	40	63,694	— 500	28·5	·5
Hull	,, 9	5,031	+ 53	41	101,204	— 467	13	..
Ilkeston	,, 6	235	— 19	40	5,649	— 91	3·5	..
Ipswich	,, 9	650	+ 58	41	16,236	— 295	10·5	..
Kilmarnock	,, 2	850	— 15	33	5,090	— 281	4·25	..
Lan'kshire Trm.Co.	,, 7	2 853	— 100	52	66,555	+ 3,012	17	1·18
Lancashire United	,, 9	4,265	+ 188	..	..	..	39	1
Leeds	,, 2	13,132	+ 77	37	263,943	+ 3,141	96·5	·25
Leicester	Dec. 26	4,498	— 114	..	..	..	..	..
Leith	Jan. 2	1,084	— 14	33½	17,775	— 22	6	..
Liverpool	,, 2	21,646	+ 371	52	555,732	— 4,384	104	..
‡L.C.C.	Dec. 26	71,305	+4,311	..	1,365,997	+153,304	121½	..
London United	Jan. 9	9,633	— 178	..	..	..	..	..
Lowestoft	,, 9	273	— 33	15	2,369	— 151	3·5	..
Manchester	,, 9	28,041	+1,250	41	618,285	+15,580	90·5	6
Newcastle	,, 9	7,686	— 188	41	159,910	— 8,224	..	..
Newport	,, 9	1,186	+ 14	41	26,984	— 1,162	14·5	..
Oldham	,, 10	3,347	— 52	41	80,717	— 590	29·75	..
Pontypridd	,, 2	792	+ 122	40	15,325	+ 4,394	5·5	1·75
Portsmouth	,, 9	2,989	+ 15	41	82,171	+ 924	14·5	..
Preston	,, 6	1,453	+ 91	..	..	..	..	..
†Reading	Dec. 31	523	— 30	39	24,686	— 93	13·25	..
Rotherham	Jan. 7	1,209	— 52	40½	24,882	+ 16	10	·66
†Salford	Dec. 28	4,519	+ 60	39	182,250	+ 1,074	41	..
Sheffield	Jan. 10	10,831	+ 116	41½	231,414	— 3,255	37	1·25
Southampton	,, 6	1,847	+ 18	40	43,489	+ 1,630	..	..
†Southend-on-Sea	,, 6	568	+ 80	41	18,577	+ 1,787	..	..
South Shields	,, 9	1,089	+ 24	..	23,070	— 362	..	..
Swindon	Dec. 30	101	— 48	..	..	..	4·4	..
Tyneside	Jan. 6	773	+ 15	27	11,229	— 926	8·37	..
Wallasey	,, 9	1,558	+ 132	40½	36,594	+ 2,040	8·72	·22
Walthamstow	,, 9	994	+ 94	41	26,128	+ 1,804	9	..
West Ham	Dec. 31	4,458	— 841	40	88,690	— 4,814	15	·3
†Wolverhampton	Jan. 6	1,510	..	40	33,688	..	12·5	..
Baker St.-Waterloo	Jan. 9	7,150	+ 640	..	..	..	4·25	1
Cen. London Rly.	,, 9	11,078	—1,484	..	..	..	6·32	·55
Char. +, Eus. Hamp.	,, 9	7,605	+1,845	..	..	..	7·75	..
City & S. Lon. Rly.	,, 10	7,378	+ 189	..	..	..	9·3	1·06
Dublin-Lucan Rly.	,, 8	283	+ 29	..	..	..	7	..
G.N. and City Rly.	,, 9	3,206	— 585	..	..	..	3·5	..
G.N., P'dy. & Brmin.	,, 9	11,690	+ 795	..	..	..	9·25	·25
†L'pool Overh'd Rly.	,, 10	2,649	— 22	..	..	..	6·3	4·3
Mersey Railway	,, 9	4,001	+ 35	..	..	..	4·5	..
Metropolitan Rly.	,, 10	33,085	+1,019	..	..	..	24·5	..
Met. District Rly.	,, 9	19,533	+1,813	..	..	..	24	..
†Anglo-Argentine	,, 7	59,949	+15,554	52	1,144,751	+255,975	42	..
‖Auckland	Dec. 4	18,524	+1,7267	48½	149,970	+23,519	22·8	8·1
Bombay (B.B.T.)	,, 12	5,239	+ 463	49	191,871	+20,098	..	..
‖Brisbane	Dec.	16,655	+1,355	..	..	..	..	..
Calcutta	Jan. 9	7,167	+ 183	..	..	..	..	..
‖Kalgoorlie, W.A.	Dec.	4,355	..	52	47,312	..	20·5	..
Madras	,, 31	1,524	+ 172	53	29,743	+ 1,960	12·75	..
Perth (W.A.)	Jan. 8	3,462	+ 179	..	..	..	25·6	..

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

INSTEAD of the cheap money for which the Stock Exchange a week ago was looking, present indications rather point to a possible advance in the Bank rate, and that, too, before very long. This complete reversal of market expectations gave a decided check to the incipient cheerfulness fostered, more or less artificially, at the beginning of the New Year, and markets of the investment order have relapsed into quietude again. The liveliest section of the markets touched upon here is that where Mexican electric issues are dealt in.

The City and South London is usually the first to declare its dividend, and the announcement was duly made this afternoon. It turns out to be at the rate of 1½ per cent., which is only ¼ per cent. less than a year ago, and rather pleased the market. The price is still 28½. The Central London declaration arrives about the third Thursday in January and July, which would make it due next Thursday if the rule is adhered to. Central London Ordinary is down 1, City and South London ½, and Districts ¼. Home Rails, as a whole, are a dull and uninteresting market. Charing Cross, Euston and Hampstead is the subject of a little interest and inquiry, and the price rose 1 to 87, business being recorded at 87⅝. At 96 and 92 the 4 per cent. Debenture stocks of the Bakerloo and the Piccadilly, respectively, are without alteration.

After falling sharply, Mexican Light and Power and Mexico Tramways have rallied, and the net movement on the week is consequently small. Mexico Trams slid from 135 to 126 with hardly a break; in fact, the shares for a brief period were all but unsaleable at anything like the nominal quotation. Recovery set in and took the price up again to 131½; while the 5 per cent. bonds are 91¾, against 90 for the Mexican Light and Power 5 per cent. bonds. Whichever company may be in the right, the squabble between them has proved disastrous to the prices of the stocks in both undertakings, and it is not surprising that some should hint at the whole dispute being spun-out in order to enable insiders to take advantage of the market fluctuations. That the meeting should be called in Montreal and not until February is doubly unfortunate for the British proprietor. Some sort of a working agreement, lease or other such arrangement between two companies we have contended from the start of the dispute that there must ultimately be, and when this is made, as we believe will be the case, there is plenty of scope in the quotations for a brisk rise. But this expression of opinion must not be construed as a Stock Exchange tip, because the common shares in both are highly speculative to buy.

Rio Trams at 82¾ show a trifling relapse, while Sao Paulo fell a point to 156. British Columbia Electric Railway Deferred has been active and firm. The Preference stock is rather better. Buenos Ayres Port and City Tramways 6 per cent. First Debenture shed about half-a-dozen points, the price dropping to 83½ without any transaction being marked in it.

Anglo-Argentine Tramways 4 per cent. Debenture stock eased off a point to 91 upon circulation, in a fairly wide area, of the underwriting in respect of the coming issue of new stock. The latter is to be offered at 90, carrying 4 per cent. interest, and the underwriting commission is 2 per cent. For such a security this may appear to be extravagant terms to offer, but were the shareholders to have the refusal of the underwriting, little could be urged against the price. We fear, however, that this is not the case, and that outsiders will benefit when insiders would be quite ready to shoulder the obligation. Should our view be wrong it will be with pleasure that we stand open to correction.

British Electric Traction First Debenture is down two points, and the London United Tramways Preference at 3¾ are 5s. lower. Underground Electric Railways issues continue to improve.

Electricity Supply shares remain in their former quiescent condition, with a few insignificant movements in the shares, none of the changes exceeding 2s. 6d. in extent. Victoria Falls Preference are 1/16 lower. Electric Construction Preference rose 1/16 to 1 1/16.

Telegraphs and Telephones tend a trifle to the duller side, although in these as well the changes are without importance. Direct United States shares lost ¼, and Anglo-American Ordinary 1, but the Deferred rose ¼. Eastern Telegraph fell a point, and beyond these there are practically no movements. National Telephones are a shade better, especially as regards the Deferred stock and the Third Preference shares. Monte Video Telephones are the turn lower; United River Plates are better. Henley's have gone quietly ahead.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Jan. 5th.	Closing Quotations Jan. 12th.	Business done week ended Jan. 12th, 1909. Highest	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	2⅜ — 5/8	2⅜ — 2⅝	..	..	..	Nil.
136,700	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	94 — 97 xd	92 — 95	98½	..	..	5 3 1
$131,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	..	129 —132 xd	129 —132	..	..	..	6 1 3
$53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 59,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95 xd	93 — 95	..	..	..	4 4 8
598,180	Anglo-American Telegraph	Stock	3½%	3½%	3½%	..	56 — 59	55 — 58	55½	..	−1	6 0 8
3,200,910	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	..	94 — 98	96½ — 98½	97½	96½	+ ½	6 1 10
3,200,910	Do. do. do. Deferred	Stock	1½%	1½%	1 %	..	14⅞ — 15⅛	15⅛ — 15⅜	14⅞	14⅜	+ ⅛	6 8 0
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 — 8½	8 — 8½	..	..	..	4 14 1
2,883,376	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	85 — 87 xd	85½ — 87½	87	86	+ ½	4 11 5
15,000	Cuba Telegraph	10	5 %	5 %	6 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	7 1 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	..	..	..	5 14 3
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3 — 3½	3 — 3½	..	..	..	5 14 3
5,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	..	8 — 9	8 — 9	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	99 —102 xd	99 —102	..	..	..	8 16 6
60,710	Direct United States Cable	20	4½%	4½%	4½%	..	12⅞ — 13⅛	12⅞ — 13⅛	12⅞	12⅝	— ⅛	6 6 5
48,000	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102 xd	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	..	128 —131	127 —130	129	127	−1	5 7 8
2,000,000	Do. 8½ % Pref. Stock..	100	8½%	8½%	8½%	..	84 — 87	84 — 87	86	84½	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red....	Stock	4 %	4 %	4 %	4 %	103½ —105½	103½—105½	104⅜	..	..	3 17 8
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	11⅛ — 12⅜	11⅛ — 12⅜	12 3/16	11⅞	..	5 13 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	102½	..	..	3 17 8
269,700	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	4 %	100 —102	101 —103	102½	102	+1	3 17 8
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10 — 10½	10 — 10½ xd	10½	10	..	5 14 8
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	..	12⅞ — 13⅜	12⅞ — 13⅜ xd	13⅛	12⅞	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	..	30 — 32	30 — 32	..	..	..	6 5 0
14,800	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102 xd	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	52 — 55	52 — 55	54	52½	..	6 16 4
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	..	74 — 78	74 — 78	..	..	..	5 2 7
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	..	71 — 74	71 — 74	..	..	..	5 12 8
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	6 %	6 %	..	7/8 — 1	7/8 — 1	17/-	..	..	+ 1/16
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	..	3/4 — 7/8	3/4 — 7/8	..	..	..	5 3 11
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108½ —110½	108½ 110½	109½	109½	..	5 8 7
3,725,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	117 —119	119 —121	120	118½	+2	4 19 2
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	..	10½ — 11½	10½ — 11½	10⅝	..	..	5 4 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	5 %	6 %	..	10½ — 11½	10½ — 11½	..	..	..	5 4 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5⅛ — 5⅜	5 7/8	5 13/16	+ 1/16	4 7 1
2,000,000	Do. do. 8½ % Deb. Stock Red. ..	Stock	8½%	8½%	8½%	8½%	97 — 99 xd	97 — 99	97½	..	..	8 10 11
1,716,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102 xd	100 —102	..	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	..	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	5 16 2
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	..	1⅛ — 1¼	1⅛ — 1¼	..	..	..	4 16 0
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	88 — 90 xd	88 — 90	..	..	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 —102 xd	100 —102	..	..	..	3 18 5
11,889	Reuter's	8	5 %	5 %	5 %	..	7 — 8	7 — 8	6 11/16	6½	..	5 0 0
99,100	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101 xd	99 —101	..	..	..	4 9 1
3,088	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	127 —130	127 —130	..	..	..	4 12 4
100,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6⅝ — 6¾ xd	6⅝ — 7	..	..	+ ⅛	5 14 3
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	4½ — 5⅜ xd	4½ — 5⅜	..	..	..	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2½	Nil	2½%	2½%	..	1½ — 1⅝	1½ — 1⅝	..	..	..	4 8 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —101 xd	99 —101	..	..	..	3 19 3
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980..	10	7 %	7 %	7 %	..	12⅜ — 13½ xd	12⅜ — 13½	13⅛	12⅜	+ ⅛	5 5 8
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
86,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	5 %	8 %	6 %	6 %	7⅜ — 8¼	7⅜ — 8¼	7⅞	7⅜	..	7 7 8
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	..	7⅜ — 8¼	7⅜ — 8¼	..	..	..	2 14 1
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100 —102 xd	100 —102	101	..	..	4 18 0

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

820,000	Anglo-Argentine Trams, 10 % Nom. Cum. 2nd Pref., 260,008 to 580,007	5	8 %	8 %	9 %	..	9 — 9¼xd	9 — 9¼	9 7/32	9 1/16	..	4 17 4
260,007	Do. 6 % Cum. Prefs., 1 to 260,007 ..	5	5⅛%	5⅛%	5⅜%	..	6¼— 6⅜xd	6¼— 6⅜	6¼	6 3/32	..	4 10 0
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	140 —145 xd	140 —145	..	..	..	4 5 9
285,100	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	101 —103 xd	101 —103	102	..	..	4 17 1
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	..	3⅞ — 4	3⅞ — 4	80/-	78/1½	..	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	8 18 10
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	..	1⅜ — 2⅛	1⅜ — 2⅛	41/8	37/6	..	15 11 2
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	3 — 3½	3 — 3½	65/7½	64/4½	..	10 0 0
40,000	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3⅞ — 4⅜	3⅞ — 4⅜	85/7½	..	+ ⅛	6 17 7
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	4 %	2¼ — 4½	3¼ — 4½	..	..	..	4 8 1
43,473	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	5 %	105 —108	105 —108	..	..	..	4 12 7
300,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	98½—100½	98½—100½	..	..	..	5 9 5
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	135 —138	135 —138	136⅞	136½	..	5 15 11
400,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	..	116 —120	116 —120	118⅝	118	..	4 11 4
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107½—109½	108 —110	109½	109½	+ ½	4 10 11
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	10 15 6
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	10	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
188,301	British Electric Traction	10	3 %	Nil	Nil	..	1 1/16 — 1 1/8	1 1/16 — 1 1/8	20/-	18/9	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	..	3½ — 4	3½ — 4	76/8	70/-	..	7 10 0
1,473,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	92 — 97	90 — 95	..	..	−2	5 5 3
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	73 — 75	73 — 75	..	..	..	6 0 1
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	..	6¾ — 7	6¾ — 7	6⅞	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	..	6¼ — 6½	6¼ — 6½	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red.. ..	100	4½%	4½%	4½%	4½%	103 —106 xd	103 —106	..	..	..	4 4 11
208,440	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	91 — 96	91 — 96	..	..	..	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	10/7½	..	..	Nil
1,016,868	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	41 — 46	41 — 46	..	..	..	8 14 0
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	9/16 — 11/16	9/16 — 11/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	2½%	Nil	Nil	..	..	..	..	..	..	Nil
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	..	..	..	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	..	65 — 70	65 — 70	67½	..	..	6 8 7
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	..	46 — 50 xd	46 — 50	..	..	..	9 0 0
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	..	4½ — 5	4½ — 5	..	..	..	6 0 0
45,304	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4⅝— 5¼xd	4⅝— 5¼	..	..	..	4 17 7
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	100 —103	100½	100	−1	4 7 5
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	9 — 10	9 — 10	9 7/16	9⅛	..	7 10 0
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5½ — 5¾	5½ — 5¾	5 13/16	5 7/16	..	4 6 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 —108 xd	106 —108	..	..	..	4 3 4
491,222	Cape E Trams., 1 to 491,222	1	Nil	Nil	Nil	..	3/16 — 5/16	3/16 — 5/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	..	1⅛ — 1⅜	1⅛ — 1⅜	31/6	30/-	..	7 10 4
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	103 —107	103 —107	105½	..	..	4 6 11
1,893,610	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	..	64 — 66	63 — 65	65⅛	63⅞	−1	4 12 4
553,195	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	..	84 — 86	84 — 86	..	..	..	4 13 0
553,195	Do. do. Def. do.	Stock	4 %	4 %	2 %	..	50 — 52	50 — 52	50½	..	..	8 16 11
1,480,000	City and South London Railway	Stock	11⅞	2⅜%	2⅜%	11⅞	28½ — 29½	28½ — 29½	29⅜	28¼	..	7 4 1
85,000	Crompton & Co., Nos. 1 to 85,000	8	2½%	5 %	5 %	..	1 1/16 — 1¼	1 1/16 — 1¼	26/10½	..	..	10 0 0
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	5 %	96 — 99 xd	96 — 99	..	..	..	5 1 0

* Unless otherwise stated, all shares are fully paid. † A period of nine months. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations Jan. 5th.	Closing Quotations Jan. 12th.	Business done week ended Jan. 12th, 1909.		Rise + or Fall —	Present Yield per cent.
		*	1905.	1906.	1907.	1908.			Highest.	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	10 %	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	7 2 10
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	..	1⅛ — 1⅛	1⅛ — 1⅛	23/1½	22/6	..	5 1 1
276,880	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102 xd	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 1 to 60,000	10	6%	6 %	6½%	..	11⅜ — 12⅛	11⅜ — 12⅛	..	..	..	5 4 0
60,000	Do. 6 % Pref. between 1 and 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 5 9
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	4½%	4½%	..	⅞ — 1 1/16	⅞ — 1 1/16	..	..	..	16 15 3
17,189	Do. "A" shares, 01—017,189	5	4½%	4½%	4½%	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	8 6 9
317,875	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	75 — 78 xd	75 — 78	..	..	..	5 2 7
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	86 — 89	86 — 89	..	..	..	5 12 4
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
81,390	Do. do. 7 % Cum. Pref., 1 to 81,390.	2	7 %	7 %	7 %	..	1 — 1⅛	1⅛ — 1⅜	..	..	+ 1/16	8 12 4
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7 — 7⅛ xd	7⅛ — 7⅜	..	..	..	6 13 4
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	83 — 87	85 — 89	..	..	+2	4 9 11
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	¾%	..	⅛ — ¼	⅛ — ¼	..	..	..	6 18 4
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10¼ — 10⅝	10¼ — 10⅝	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —108	102 —109½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	..	11⅜ — 12½	11⅜ — 12⅝	12⅝	12	+ ⅛	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105⅛—107⅛	105⅛—107⅛	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10%	10 %	10 %	..	16 — 16⅜ xd	15⅞ — 16⅛	16⅛	15 1/16	— ⅛	6 1 3
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	½%	..	1 — 1⅛	⅞ — 1	..	..	— 1/32	5 0 0
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	..	4 — 4½	4 — 4½	..	..	..	11 2 2
600,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	3 %	..	6⅛ — 6⅜	6⅛ — 6⅜	..	..	..	4 8 11
399,930	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	..	6⅛ — 6⅜	6⅛ — 6⅜	..	..	..	4 8 11
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	..	3¾ — 4⅛ xd	3¾ — 4	75/-	72/6	— ¼	12 10 0
1,381,000	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	66 — 70	66 — 70	..	..	..	5 14 4
5,782,062	Metropolitan Consolidated	100	2⅜%	1 %	½%	..	36 — 37	36 — 37	36⅛	35⅜	..	1 7 0
2,640,914	Do. Surplus Lands	100	2⅜%	2⅜%	2⅜%	..	68 — 70	68 — 70	£9⅜	69	..	3 18 7
8,285,000	Do. District	100	Nil	Nil	Nil	..	13⅛ — 14	13⅛ — 13⅜	13⅜	13⅛	— ¼	Nil
814,016	Metropolitan Electric Trams., Defd.	1	Nil	Nil	Nil	..	⅝ — ¾	⅝ — ¾	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	⅝ — ¾	⅝ — ¾	16/3	15/6	..	5 19 5
823,800	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	91 — 94 xd	92 — 95	93½	..	+1	4 14 9
245,500	Potteries E. Tro.	1	4 %	4 %	4 %	..	¼ — ⅜	¼ — ⅜	5/7½	..	..	8 0 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	¼ — ⅜	¼ — ⅜	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	90 — 93	90 — 93	..	..	..	4 14 9
87,350	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	..	31 — 33	31½ — 33½	33	32½	+ ½	6 10 7
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99 —102 xd	99 —102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	..	..	95 — 96	97½ — 98½	97⅞	96½	+2½	..
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	73 — 75 xd	74 — 76	74½	..	..	..
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	22 — 24	22 — 24	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	Nil	10 %	..	⅝ — ¾	⅝ — ¾	..	..	..	10 0 0
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	Nil	..	6 %	..	2⅜ — 2¾	2⅜ — 2¾	..	..	..	10 8 8
246,404	Do. 4 % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5⅛%	5⅛%	5⅛%	..	4½— 5	4½— 5	..	..	..	5 10 0
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	94 — 98	94 — 98	..	..	..	4 10 0
80,275	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	..	8½ — 9	8⅝ — 9	8⅝	8⅜	..	5 12 8
9,725	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	8 — 8½	8 — 8½	8	..	..	4 2 4
886,876	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	98 — 101	99 —101	..	..	+ ⅛	3 19 3
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	..	4⅜ — 4⅝	4⅜ — 4⅝	95/-	..	..	5 2 7
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	4¼ — 4⅜	4¼ — 4⅜	90/-	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	8¼ — 4⅜	8¾ — 4½	..	..	— ⅛	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	96 — 98 xd	96 — 98	..	..	..	4 1 8
49,486	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	..	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	5 5 11
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102 —105 xd	102 —105	103	..	..	4 5 9
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	..	10⅜ — 10⅝	10⅛ — 11	10⅝	..	— 1/16	5 9 1
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	12¼ — 13	12¼ — 13	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	121 —123 xd	121 —123	123	..	..	4 1 4
300,000	Do. 4½ % 2nd. Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	4½%	99 —101 xd	99 —101	..	..	..	4 9 1
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	2⅜ — 3	2⅜ — 3	..	..	..	3 6 8
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	..	3¾ — 4	3¾ — 4	..	..	..	6 5 0
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	96 — 98 xd	96 — 98	..	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	..	8⅞ — 9⅜	8⅞ — 9⅜	..	..	..	5 7
50,026	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10⅜ — 11½	10⅜ — 11½	..	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	4½%	105 —108 xd	105 —108	106½	105	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —102	100 —103	..	..	+1	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	4 %	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6	3 %	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
450,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	62 — 65	61 — 64	62	..	—1	7 0 8
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	..	..	83 — 85	83 — 85	..	..	..	..
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 4 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	..	5 — 5⅛	5 — 5⅛	..	..	..	4 10 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 — 100	..	..	..	4 10 8
15,000	Hove, 1 to 15,000	5	9 %	9 %	8⅞%	..	6⅜ — 6⅞	6⅜ — 6⅞	..	..	+ 1/16	6 3 8
$1,325,000	Kaministaquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	94 — 95 xd	94⅜ — 95⅜	..	..	+ ⅛	5 4 9
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	10 %	..	7⅜ — 8⅛	7⅜ — 8⅛	..	..	..	6 1 3
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 — 97	95 — 98	..	..	+1	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	..	1⅜ — 1⅝	1⅜ — 1⅝	33/9	..	..	3 6 8
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	..	4⅛ — 5⅛	4⅛ — 5⅛	..	..	..	5 14 3
374,395	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	89 — 93	89 — 93	..	..	..	4 16 9
200,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	8 %	6⅜%	..	5 — 5⅛	4⅞ — 5⅛	5 1/16	5	— ⅛	5 10 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	..	4⅝ — 5⅛xd	4⅝ — 5⅛	93/9	..	..	4 5 9
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	4½%	105 —108 xd	105 —108	..	..	..	4 3 4
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	85 — 88 xd	85 — 88	..	..	..	3 19 7
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	85¼ — 86¼xd	85 — 86	85⅞	85	— ⅛	5 16 3
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	..	..	76 — 77	76 — 77	77⅛	73⅜	..	..
$1,500,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	..	105⅜—107⅛	106 —108	107⅛	105⅜	+1	..
$12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	89⅜ — 90⅜	89⅜ — 90⅜	90½	89⅛	..	..
260,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	93 — 96 xd	93 — 96	..	..	..	4 13 9
87,500	Newcastle-on-Tyne, 1 to 87,500	5	8 %	8 %	8 %	..	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	7 16 1
87,500	Do. 5 % Pref., 1 to 87,500	5	5 %	5 %	5 %	..	5⅛ — 5⅜	5 — 5⅛	5 1/16	..	— 1/16	4 10 11
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	..	100 —102	..	..	..	..	..
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7½%	..	11⅜ — 12⅜	11⅜ — 12⅜	..	..	..	5 17 8
20,000	Oxford, 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	..	5⅛ — 6⅜	5⅛ — 6⅜	..	..	..	5 9 10
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	..	2½%	..	..	1⅜ — 1⅝	1⅜ — 1⅝	23/9	..	..	..
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6	6	6	..	1⅛ — 1⅜	1⅛ — 1⅜	20/6	..	..	..
194,684	Do. do. 5% Deb. Stk. Red.	100	5	5	..	5 %	98 —101	98 —101	..	..	..	4 19 0
40,000	St. James' and Pall Mall Electric Light, Ord.	5	12½%	10 %	10 %	..	8⅝ — 9⅛	8⅝ — 9⅛	9	..	..	5 9 7
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	..	7 — 7⅛	7 — 7⅛	..	..	..	4 18 4
150,000	Do. do. 3½ % Deb. Stock Red.	100	3 %	3½%	3½%	3½%	86 — 90 xd	86 — 90	..	..	..	3 17 9
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	..	⅝ — ¾	⅝ — ¾	..	..	..	Nil
46,700	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	68 — 72	68 — 72	..	..	..	5 11 1
65,000	South London Electricity Supply, Ord.	4	4 %	3 %	4 %	..	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	2⅞ — 3	2⅞ — 3	..	..	..	3 6 8
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	..	1⅜ — 1⅝	1⅜ — 1⅝	23/-	..	..	5 16 8
200,000	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100—103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	⅞ — 1	⅞ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅝ — 2	1⅝ — 2	..	..	..	12 10 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	80 — 83	80 — 83	..	..	..	5 8 5
800,000	Victoria Falls Power Co., Pref. Nos. 1 to 800,000	1	..	..	..	..	31/32 — 1	31/32 — 1	..	..	..	..
110,000	Westminster Electric Supply, Ord.	5	13 %	17 %	10 %	..	7⅛ — 8⅛	8⅛ — 8⅝	8⅝	..	..	5 14 3
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5⅜ — 5⅝	5⅜ — 5⅝	5⅝	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange. § Interim Dividend.

REVIEWS.

Technical Thermodynamics. By Dr. Gustav Zeuner. Vol. II. London: Constable & Co., 1907. Price 36s. (two vols.).

In the second volume of this great work, vapours are more particularly referred to. Vapours consist of incomplete gas, they only exist in the presence of their mother liquid, or within a few degrees of temperature higher than the mother liquid was before it all became converted into vapour. Such a vapour is termed saturated. With additional heat they become superheated, and pass into the state of perfect gas. Vapours do not obey the law of Mariotte, their characteristic curve not being the rectangular hyperbola, but a curve such as pv^p = constant, p being a fractional number. The author takes as the atmosphere of pressure—

1·0333 kg. per 1 sq. cm. [2,116·3 lb. per sq. ft.].

But in this treatise he uses as a pressure unit the kilogram per sq. cm., so that when he speaks of so many kilograms of pressure, he means something less than so many true average atmospheres.

The formulæ inter-relating pressure and temperature for vapours are, therefore, somewhat complex, and in the appendix there are numerous fully-calculated tables of the properties of saturated vapours such as water, ammonia, carbon bisulphide, CO_2 and sulphurous acid, such as are employed in refrigeration, and in binary vapour engines.

The whole technics of vapours will be found fully discussed, including Batelli's recent investigations into the properties of saturated and superheated steam.

On the question of the non-agreement between actual indicator diagrams and calculated curves for expansion, the author remarks that, in the first place, there is no doubt that an exchange of heat takes place between the expanding steam and the cylinder walls, and in the second place, it can be regarded as certain that the expansion curve is not, strictly speaking, any equilibrium-pressure curve.

On the subject of superheated steam, the author finds that the method of superheating by mixture of saturated with highly superheated steam possesses no advantage as to the steam, though he does not dispute that Wethered's experiments may have shown an economy referred to fuel, but not from other than mere mechanical reasons connected with the supply of heat to the superheater. It was probably a mere coincidence that Wethered happened to experiment with apparatus that was so proportioned as to give such results. Generally, on the question of superheated steam and its specific heat, the author favours the view that specific heat increases with the pressure, but diminishes with rise of temperature; but the records of experiments differ so much that it is difficult to say what is the true specific heat. It is much to be hoped that this question will be solved at the National Physical Laboratory before long, for the whole matter is in a state of great uncertainty at present. According to Lorenz the value of c_p for superheated steam may be satisfactorily formulated as—

$$c_p = 0{\cdot}43 + 3{,}600{,}000\,\frac{p}{T^3}$$ in metric measures, or

$$c_p = 0{\cdot}43 + 1{,}476{,}000\,\frac{p}{T^3}$$ in English measures. Here, by the way, a word of praise should be awarded to the translator, for he has given the English formulæ throughout the book in brackets below the metrical formulæ, and he has also translated all the tables into English measures, with few exceptions.

The latter half of this second volume is given over to applications, and here we find steam engines for saturated vapours, and engines for superheated steam, with the investigation of the cycle of the actual engine and loss of work due to imperfection of cycle, to incomplete expansion, to clearance; the action of compression, and the loss of work due to the wall action.

There is a section on cold-vapour engines, including refrigerating machines. In this section the action of the cylinder walls is investigated, but no conclusions are drawn, nor does it seem likely that any general formula can ever be evolved that will fit all engines, if any engines.

The whole treatment of the subject is highly mathematical, and thoroughly to read the book demands, unfortunately, a better knowledge of mathematics than most engineers possess. But the student of prime movers of the heat engine class should study this book, for it is, perhaps, the finest presentation of the subject that has ever appeared. It is, indeed, a monumental work.

Industrial Electrical Measuring Instruments. By Kenelm Edgcumbe. London: Archibald Constable & Co. Price 8s. net.

This book forms a useful addition to the electrical text-books, as it collects into a small space a considerable amount of information which has hitherto only been obtainable, at least in English, in the pages of the technical papers. Though confined to a single branch of electrical apparatus, it is not a specialist's book, but deals on quite elementary lines with the design and construction of the ordinary electrical instruments (excluding house supply meters), and can be recommended to all those having the charge of instruments as well as to students.

The first part of the book is devoted to descriptions of moving-iron, moving-coil, induction and hot-wire ammeters and voltmeters, their sources of error and methods of construction and calibration. Then follow sections on the measurement of power and descriptions of dynamometer, induction, hot-wire and electrostatic wattmeters, and their use on single-phase and polyphase circuits.

Amongst the more special apparatus next dealt with, come phase and power-factor indicators, synchronisers, frequency indicators, instrument transformers, curve tracers and oscillographs, leakage detectors, maximum, minimum and reverse current cut-outs, relays, lightning arresters and pyrometers. It will be seen that the book covers more than is usually understood by the term "measuring instruments."

The treatment is fairly complete as regards constructional details and mode of action, but the critical comparison of the relative merits of various types and makes might be fuller, and the important question of relative cost as influencing the selection of instruments for various purposes should at least have been touched on.

The diagrams are clear and numerous, but, in the choice of examples, somewhat undue prominence is given throughout to the author's own manufactures.

Electric Power and Traction. By F. H. Davies London: Archibald Constable & Co. Price 6s. net.

In this book the author addresses members of the trades allied to or connected with electrical engineering more or less directly, rather than those actually engaged in the last-named industry; the treatment is therefore somewhat general and highly condensed. The author has set himself a difficult task, and has accomplished it very satisfactorily on the whole; precision of statement, perhaps, can hardly be demanded in a work of this nature, or we should take exception to such a remark as that on p. 5—namely, that if the pressure of supply be doubled, the amperes remaining the same, double the amount of power can be transmitted through a cable without increasing the quantity of copper. While this is literally correct, the statement ignores the fact that the efficiency is also doubled, and that in reality, with the same efficiency as before, four times the power can be transmitted for the same distance, or alternatively twice the power can be transmitted 40 per cent. further, with the same quantity of copper. The author proceeds to describe in clear and simple language the arrangement and working of a D.C. power station and distributing system, following with an account of the A.C. system, which is introduced with daring originality by a description of a transformer.

In the fourth chapter the author has already arrived at power distribution by polyphase currents, at pressures up to 60,000 volts, and even hints at 180,000 volts; naturally, therefore, we are not surprised to find him dealing with the advantages of electric motive power in Chapter VII, after brief descriptions of D.C. and A.C. motors in the two intervening chapters.

Electric power in collieries, engineering workshops, printing offices, on board ship and on canals each receive a short chapter, and the remainder of the work—about half of it—is devoted to electric traction on tramways and railways.

Compared with the preceding sections, this subject receives perhaps too much attention; we here meet with details of an historical nature, which in the earlier part of the work are wisely excluded. For instance, particulars of antiquated and long obsolete surface-contact systems are given. The book concludes with a glossary of terms. The author is to be congratulated upon having written a very readable book, which ought to be welcomed by a large circle of readers.

Development and Electrical Distribution of Water Power. By Lamar Lyndon. London: Chapman & Hall. Price 12s. 6d. net.

This is a work on a very interesting subject, and one with which the author appears to be well acquainted so far as the hydraulic work is concerned. The prefatory remark that "the best way to investigate a problem is to discover all that has been done in the same field by engineers of ability, and take this combined knowledge and experience as the starting point" would seem to imply that, in the community to which the author belongs, knowledge and experience occasionally come only when the work is completed. The above order is not precisely new over here.

The first part of the book is painstaking, and, except for the omission of reference to low-fall schemes, sufficient. The utilisation of small head and large flow is one of the problems of this work, however.

In Part II, the first remark that strikes the eye is one relating to "alternating-current systems, in which the load is non-inductive, such as incandescent lamps, electrolytic tanks . . . ," some mistake about the electrolytic tanks on alternating systems, surely. Also, one does not quite understand why it is recommended that the water-wheel should have a capacity 15 to 20 per cent. greater than is required to drive its dynamo, unless gearing losses are here indicated. Intentional and premeditated overloading can only mean paying for and turning round a larger machine than is necessary. Many of the references indicate an imperfect examination of the subject—such as the remark about "danger of conflagration in oil-cooled transformers, and "dangerous shocks from static discharges." These matters are the subject of common and well-known precautions in practice.

Page 124 needs some revising. In the first place, it is not at all apparent why a description of insulators would be out of place. Secondly, surely, in testing insulators, it is not the "pressure" that is shown by vicious arcing, but the "presence" of defect. The prices given for porcelain insulators seem remarkably low.

Fig. 64, exit of wire from power house for pressures up to 30,000 volts, shows a type of insulator of very modest dimensions for the pressure.

The extracts from technical papers which conclude the volume, however, are so interesting that one wonders why a collection of this kind is not more frequently made.

The Principles of Alternating Currents. By Edgar T. Larner. London: Crosby Lockwood & Son. Price 4s. 6d. net.

This little work of 132 pages, and seven chapters, is intended for the somewhat large class of "non-mathematical" electrical engineering student.

The hopeful student who buys this treatise, thinking that afterwards he will have a perfect knowledge of "three-phase," will be disappointed, since the author very rightly deals only with fundamentals.

The book is of the "sine curve" variety, and there does not appear to be anything in it differing greatly from what one finds in the almost countless number of treatises on this subject already on the market.

Chapters II and III deal with "simple harmonic motion" and "vectorial representation"—somehow vectors and calars, in spite of their names, are not particularly helpful to a beginner. It seems rather absurd to expect students, many of whom have great difficulty in calculating the area of a square, or circle, to understand what vectors are, and after they think they do understand them, they find how little use they are in solving their problems. Yet here we have vectorial representation, and the dry-as-dust triangles.

On page 73 the student will read with surprise, how the quantity represented by the area of the half waves is found "by means of the *integral calculus* to be $\frac{2\,c_0}{p}$," and again, on page 75, "the area covered by $c^2\,t$ continuous = twice the area covered by $c^2\,t$ alternating," which is, doubtless, exact enough, but not at all obvious.

A good deal of space is taken up with analogies, viz., hydrostatic and mechanical analogies to illustrate Ohm's law, and others to illustrate the effects of inductance and capacity.

In Appendix B is given a method of resolving a vector into two components, which seems rather unnecessary after the vector polygon on page 98, and diagram on page 104.

Here and there the language used by the author seems rather ambiguous. For instance, in the preface, "it is hoped that earnest students . . . . will advance to the more learned productions"; on page 128, "A single-phase alternator of 5,000 volts at 50 cycles . . . . is applied to a cable of 6 microfarads capacity"; page 113, "An alternating P.D. . . . . is applied across the terminal"; same page, "A condenser is put in parallel with a non-inductive resistance, across mains"; page 99, "Find the potential difference across the terminals."

The book is excellently printed and illustrated, and, doubtless, will be found of use by the type of student for whom it is written.

SOME LEADING CASES OF 1908.

[BY OUR LEGAL CONTRIBUTOR.]

Most of the cases dealing directly with the law relating to electricity were reported in the columns of the Electrical Review during the year. At the commencement of a new year, however, it may be found useful to collect and summarise a few of the more important of these.

In one case (North-Western Rubber Co. and Huttenbach, 1908, 2 K.B. 907) a point of interest to those concerned with the importation of rubber was considered by the Court of Appeal. It appeared that, by a contract in writing, sellers sold to buyers 300 tons of rubber "fair quality Banjermassin Jelutong at £18 15s. per ton c.i.f. Liverpool . . . . for direct shipment from the East or Straits Settlements to Liverpool . . . ." The contract contained an arbitration clause in the following terms: "Any dispute on this contract to be settled by arbitration here in the usual way." On arrival at Liverpool the buyers refused to take delivery on the ground that the goods were not in accordance with the contract. The dispute was referred to arbitrators, who found that the goods were not in accordance with contract, but must be accepted by the buyers at an allowance of 10s. per ton. The award was based upon the existence of an alleged custom applicable to contracts for raw material to be shipped to this country, to the effect that the buyers should accept the goods with an allowance for inferiority of quality, where that inferiority was, in the opinion of the arbitrators, not excessive or unreasonable. Upon a motion by the buyers to set aside the award, the Court directed an issue to determine the existence of the alleged custom, and upon the trial of the issue the alleged custom was found not to exist. It was held that the arbitrators had no jurisdiction to deal conclusively with the question of the existence of the custom for the purpose of making their award, and that, as the custom upon which they based their award had been found not to exist in fact, the award compelling the buyers to accept goods not in accordance with the written contract was bad and must be set aside.

Cases actually dealing with doubtful points arising in contracts relating to the supply of electric light are so few and far between, that it is well to make careful note of any that

do occur. In one which was heard in the Privy Council last year, the respondents were under contracts to establish an electric light central station in B., and to supply light to the inhabitations and to the streets, public places, and private property, and, in order to carry out that undertaking, to do certain specified things and to provide everything which might be necessary, whether specified or not, for the purpose of supplying electric light to the street lamps. In consideration thereof the appellants by the same contract were bound to pay "at such rates as will yield to the contractors a return equal to 10 per cent. over the actual cost of generating the light." It was held that, according to the true construction of this contract, "generating the light" covered the whole series of operations leading up to the production of the light in the street lamps, and the "actual cost" thereof covered all that the production of the light cost, including depreciation of plant, rent, rates, taxes of the electric works and buildings, and insurance. (Bulawayo Municipality *v.* Bulawayo Waterworks Co., 1908, A.C., page 241.)

The practice of letting machinery out on hire has become very common in recent years. It is important for both the landlord of the premises on which it is used, and also for his tenant, to know whether it can be distrained for rent in arrear. In one case which was heard in the Divisional Court last year, a gas engine was let out by the plaintiffs on hire under an agreement in writing which provided for monthly payments, and that the engine should remain the property of the plaintiffs until the hirer had exercised the option of purchase given by the agreement, and should be removable by the plaintiffs on the failure of the hirer to pay any instalment. The engine was affixed to the floor of premises, of which the hirer was the defendant's tenant, by bolts and screws, and was used by the hirer for the purposes of his trade. The engine was seized by the defendant under a distress for rent due from the hirer, and sold. It was held that the engine had become a fixture, and was, therefore, not distrainable. (Crossley Bros., Ltd., *v.* Lee, 1908, 1 K.B. 86.)

Owners of machinery who hire it out, must needs provide that the hirer shall not mortgage the premises without giving them due warning. Otherwise they may find themselves deprived of their property. In a case decided last year (Ellis *v.* Glover, 1908, 1 K.B. 388), it appeared that in November, 1902, a freehold laundry was mortgaged in the usual form for £400, the mortgagor covenanting not to remove any fixtures without the written consent of the mortgagee. In June, 1903, trade machinery was fixed up in the premises under a hire and purchase agreement, which provided that it should not become the property of the hirer until all instalments had been paid, and should be removable by the owner on the failure of the hirer to pay any instalment. Default having been made in payment of an instalment, the owner entered and removed the machinery. In an action by the mortgagee against the owner of the machinery for wrongful removal, it was held (reversing the decision of Phillimore, J.), that the machinery passed to the mortgagee as part of the freehold.

Some of the leading decisions of the year in relation to Workmen's Compensation may be thus summarised.

In an ordinary case the average weekly earnings are to be calculated by dividing the total earnings of the workman during the relevant period, not by the number of weeks in that period, but by the number of weeks actually worked within that period; days in which no work is done and no wages are earned are to be disregarded. But this principle does not apply to cases under Sec. 1 (*a*) (i.) of the First Schedule. (Perry *v.* Wright, 1908, 1 K.B. 441.) A charwoman coming regularly to wash premises on Fridays and alternate Tuesdays was held to be entitled to compensation. (Dewhurst *v.* Mather, 1908, 2 K.B. 754.) A collier who was travelling free in a train to his work, and was injured, was held to have suffered an accident arising out of and in the course of his employment. (Cremins *v.* Nettlefolds, 1908, 1 K.B. 469.) A posthumous illegitimate child is entitled to claim compensation as being a dependent on its deceased father. (Schofield *v.* Orrell Colliery Co., 1908, W.N. 243.) Tips habitually and notoriously received by a workman may be taken into consideration for the purpose of arriving at the wages which he earns (Penn *v.* Spiers & Pond, 1908, 1 K.B. 766.) A stoker who met his death by heat-stroke on board a steamer, was held to have sustained an accident (Ismay *v.* Williamson, 1908, A.C. 437). In order to prove a claim on the ground that deceased suffered and died from lead poisoning it is necessary to show that the poisoning was at least a remote cause of the death (Haylett *v.* Vigor & Co., 1908, 2 K.B. 837). Death caused by enteritis from the inhalation of sewer gas is not accidental within the meaning of the Act (Andrews *v.* Andrews, 1908, 2 K.B. 567).

One of the most important compensation cases is that which decided that, where a workman will not consent to undergo an operation which is perfectly safe and likely to increase his capacity for work, they may reduce the compensation awarded to him in weekly payments (Warncken *v.* Moreland, 1908, W.N. 252). It has also been decided that the central Unemployment Body are employers, and as such are bound to pay compensation within the Act (Porton *v.* Central Unemployed Body for London, 1908, W.N. 242).

The case of Workman *v.* Lloyd Braziliero, 1908, 1 K.B., 968, which, from the lawyer's point of view, raises a mere question of practice, is of considerable practical importance to persons entering into large contracts. As many people are aware, there is a summary procedure in the High Court by means of which money can be recovered with the least possible delay if there is no shadow of defence. In effect, the Court of Appeal has declared that this procedure is applicable to any one of the instalments due on a contract for works. In the case in question, by a contract between the plaintiffs and the defendants for the construction of a steamer by the former, the price of the steamer was to be £89,800, to be paid by the defendants by five instalments, which were respectively to become due at different stages of the construction of the vessel. By the terms of the contract the hull and materials of the vessel were, upon payment of the first instalment, to become the absolute property of the purchasers, subject only to the builders' lien for any unpaid purchase money; and, in the event of any instalment of the purchase money remaining unpaid for 14 days after the same was due, the builders were to be entitled to interest thereon at £5 per cent. per annum until payment, and, in the event of such default, they were to be at liberty to suspend the work, and the time of suspension was to be added to the contract time, or they might complete the vessel at any time after the expiry of 14 days' notice given to the purchasers, and might sell her after completion, and any loss on such vessel was to fall upon the purchasers, and any balance of the proceeds of such sale which might remain, after satisfying all lawful claims of the builders, was to be paid by the builders to the purchasers.

The first instalment of the purchase money having by the terms of the contract become due, and remaining unpaid, the plaintiffs brought an action for the same, and applied for leave to sign judgment for the amount so claimed. It was held that they were so entitled.

The case of Shea *v.* Reid—Newfoundland Co., 1908, A.C. 520, although hailing from Newfoundland, may at some future time be of use as a precedent in this country.

The respondents were empowered by Sec. 42 of their charter to remove snow and ice from their tracks so as to enable them to operate their cars, conditioned upon their levelling the said snow and ice on each side of the tracks to a uniform depth to be determined by the appellant's engineer, and so as not to impede the ordinary traffic of the streets. It was held that, if removal of some of the snow from the streets was necessary to comply with the engineer's undisputed requirement as to level, such removal, though not expressly prescribed, must be effected by the respondents, as physically necessary to the fulfilment of the condition.

The case of South-Eastern Railway Co. *v.* National Telephone Co., 1908, 2 Ch., 50, illustrates some of the difficulties which beset the Postmaster-General in relation to telephones.

By Sec. 6, Sub.-Sec. 1 of the Telegraph Act, 1863, the Postmaster-General has power to place a telegraph under any public road, and by sub-Sec. 4 he can place a telegraph over or across a railway. By Sec. 32 of that Act he must not place any work over or across a railway without the consent of the directors thereof; but by the proviso to that section he is not restricted from placing any work in a public road because the road crosses a railway. But Sec. 32 does not say

that in such a case the work shall be deemed not to be carried across a railway. Therefore, a licence by the Postmaster-General which empowers a telephone company to exercise his powers of executing works other than works under, in, upon, over, along or across any railway, does not authorise them to lay a cable in a public road on a bridge which crosses a railway without the consent of the railway company, who are owners of and liable to repair the bridge, but do not repair the road.

In the case of Postmaster-General *v.* National Telephone Co., it was laid down that private telegraph or telephone lines connecting two or more separate and independent persons or businesses, and non-telephonic fire alarms and other electric signals, fall within Sec. 5 of the Telegraph Act, 1869, and are, therefore, excepted from the monopoly of the Postmaster-General.

A SYSTEM OF RECORD KEEPING AS APPLIED TO ELECTRIC RAILWAY AND TRAMWAY EQUIPMENT.

By R. J. M. HOLMES, A.M.I.E.E., A.M.I.Mech.E.

Probably one of the chief difficulties of the man who is responsible for the maintenance of the rolling stock of an electric railway or tramway system, is the problem of keeping account of the way in which the various component parts which go to make up a complete car are stored, interchanged and re-used, as wear and tear and the inevitable minor defects and accidents make their demand upon the stock at his disposal. The keeping of true and correct records of every detail of the equipments is a fundamental principle, from which can be instantly ascertained the life of any part, both as regards mileage and time run, whilst at the same time it enables one design to be fairly contrasted against another, and modifications or improvements can be introduced wherever necessary. All these functions form, or should form, part of the duties of a superintendent of rolling stock, and, if properly carried out, are bound to lead to the two main points for which he strives, namely, the efficiency of his department and economical running costs.

At first sight the difficulty would appear to be satisfactorily met by keeping a species of day book, in which alterations, replacements and repairs could be logged, and the items in which could be transferred to a ledger system. Anyone, however, who has attempted such an arrangement, will shortly be confronted with an enormous amount of book-keeping, and if the tramway system is at all extensive, he will accumulate a library of manuscript, which will be chiefly valuable as a monument of intense complication. It is possible, however, by availing oneself of the modern system of indexing information by means of card filing, to collect all the material particulars of car maintenance in a handy and concise form, which will always be up-to-date and quite complete enough for the superintendent to give an accurate answer regarding the life, performance, or disposal of any part of the equipment under his charge. It may therefore be of interest to briefly describe a card filing system of record keeping which the writer has developed in connection with the operation of the electric tramway system with which he is associated, and which he has found to give satisfactory results. It is not claimed that the system is unique, as other tramways may have somewhat similar card files, but it will probably be of value as an indication of modern methods of dealing with this subject.

The usual tramcar may be considered as being made up of seven main sections which are liable to displacement with reference to one another. These components are: The car body, the controllers, the truck, the motors, the armatures, the axles, and the wheels or tires. The first step in the system is to make out a series of cards, say, 5 in. × 3 in., for each of these items, and to number them in accordance with a reference number which should be stamped on each part of the equipment. If possible and convenient, this number should be the maker's series number which is to be found on such apparatus. Having made up these cards, they should be grouped together into sets corresponding with the way in which the parts of the equipment are assembled on each car, and held together by india-rubber bands. Each group of cards will then correspond to one complete car, and they should be arranged in numerical sequence and filed in a card-filing cabinet. The face card of each group is the car-body card, which bears the car number and also coincides with the number in the works register books. The car-mileage book is kept by the Traffic Department and the mileage of each car is taken from the way bills and entered up each day.

The way in which records are kept can best be seen by showing the items scheduled on each card. Taking first of all that for the car body, this should be ruled as follows, both sides of the card being used:—

RECD.	MAKERS	CAR BODY No.
DESCRIPTION		

DATE IN	DATE OUT	MILEAGE	REMARKS

In the "description" column, such information as whether the car is of single or double-deck type, whether it is a bogie or single truck car, whether it is a top-covered car, &c., should be given. In the "received" space, the date on which the car was received from the makers, or as the case may be, from the constructional shop of the department, should be entered. The first "date out" is the date on which the car first runs out on service, and the dates "in" and "out" should be entered up each subsequent time the car is brought into the works for body alteration, large repairs and repainting, such work to be entered in the "remarks" column, and the mileage between each date entered in the "mileage" column.

The controller card bears a reference column to the car body it is fixed upon. All defects and replacements with

RECD.	MAKERS	CONTROLLER No.
DESCRIPTION		

DATE IN	DATE OUT	CAR No.	MILEAGE	REMARKS

regard to the controller case, blow-out coils, and the two drum barrels must be recorded. Minor repairs, such as fixing a new contact finger or repairs to interlocking gear, need not be entered up.

The remarks with reference to the car body card apply generally to the truck card, which is made out with the following headings:—

RECD.	MAKERS	TRUCK No.
DESCRIPTION		

DATE IN	DATE OUT	CAR No.	MILEAGE	REMARKS

The truck number should, if possible, be the maker's order number, and in the "description" space should be stated the maker's "style No.," *e.g.*, "No. 33 H," or "26 E," and information as to whether the trucks are maximum traction or equal wheel bogies, &c. The rest of the card needs no special explanation, except that Column 3 gives the cars on which the truck is successively used.

With reference to the motor card next shown, it will be noticed that a column is given for the truck number, this being entered up in the same way that the car number is entered up on the truck card.

RECD.	MAKERS	MOTOR No.
DESCRIPTION		

DATE IN	DATE OUT	TRUCK No.	MILEAGE	REMARKS

The description of the motor will be the maker's "type" number, *e.g.*, "Westinghouse No. 200," "G.E. 58," &c. In the "Remarks" column are entered up any particulars concerning the field coils, and other repairs necessary to the motor case.

Very little need be said about the armature card, beyond noting the fact that it bears a reference column for the motor number. All troubles relating to the commutator, coils, core or spindle, are entered up in the "Remarks" column.

RECD.	MAKERS	ARMATURE No.		
DESCRIPTION				
DATE IN	DATE OUT	MOTOR No.	MILEAGE	REMARKS

We can next consider the axle card. It will be seen that, in addition to the usual reference columns, there are two extra spaces devoted to the wheels or tires, as the case may be. This is arranged to meet the frequently occurring case of wheels being pressed off the axle and new ones being substituted, or if steel tires are used, the spaces are reserved for the tires, and in such cases the wheel centres once pressed on to the axle should never, if possible, be removed, as the operation of pressing on and off greatly reduces the life of both axle and centre, and if left on, the mileage of the centre consequently corresponds to the mileage of the axle. As it frequently happens that old wheels are turned up and used again, the axle card should be transferred to a special drawer in the cabinet, which will really be a stock drawer, and kept in this during the time they are in the shops and until they are placed on another car. This applies to all cards.

RECD.	MAKERS	AXLE No.				
DESCRIPTION						
Date In	Date Out	Truck No.	Mileage	Remarks	Wheel No.	Wheel No.

It will, the writer thinks, be seen that the system outlined above, though possessing nothing of a very startling character, is calculated to lessen materially the labour of the man in charge of the department, and may therefore be of interest to some other traction engineer.

THE UNIVERSITY AND ENGINEERS.

DR. FLEMING'S ATTACK.

BY A UNIVERSITY GRADUATE.

FROM time to time spasmodic efforts are made to arouse some enthusiasm among engineers on behalf of the University of London. It cannot be said that very much success so far has resulted. It is different in the Provinces. In Lancashire, Yorkshire and the Midlands they have a local patriotism; they raise large sums of money for higher technical education. In London there is little money, much overlapping and a possibility of muddle. The average engineer in Manchester or Birmingham is proud of the local University; the average engineer in London knows nothing about the University, and shows little interest in its doings.

When we reflect upon these matters, the whole thing seems very strange. London is the hub of the Empire. Under the tropical glare of the Egyptian sun, in the bowels of the battleship, or on a remote railway in Canada, no negligible portion of the work of the Empire is being done by the engineer. The brain that plans the supply system to a town, or devises an irrigation system for a country requiring cultivation, is an important national asset. We of this generation are dependent upon the London and other Universities for our future engineers; their usefulness will be affected by their training. For the moment we will accept the statements which are made in the provincial Press, that all is well with their Universities. But what about London?

Prof. Fleming voices the views of many who have studied the problem of engineering education in London, in last week's *Engineering*. He calls aloud for reform. He concentrates his demands on a change in the syllabus for the University degree. He leaves alone the vexed question of the internal and external degrees in engineering, and other difficult problems.

Engineers as a body have a right to know what a University degree really means. Prof. Fleming complains that a student in London can become a graduate in engineering without showing evidence that he knows the difference between alternating and direct currents. The student of civil or mechanical engineering must satisfy the examiners in the three subjects of "Strength of Materials," "Theory of Structures," and "Theory of Machines." The electrical engineering student must take two of these three subjects—two of them, and "Electrical Technology." There is also a second part to the final examination. The student may select any two out of seven subjects, viz., "Hydraulics," "Surveying," "Theory of Heat Engines," "Electrical Design," "Generation, Transmission and Distribution of Electrical Energy," "Advanced Theory of Machines and Structures," and "Maths." If the undergraduate wishes to take an honours degree he must pass in three of the above seven subjects. The cry now is that no degree in engineering should be granted to a man unless he knows something about electricity; he should be made to take a paper in electrical technology.

It appears at first sight that the case has only to be stated to be conceded. But the above state of affairs exists; it remains to-day as it was six years ago. Prof. Fleming pleads for a reform, and every progressive reader of this and other technical papers will surely wish him success in his efforts. The mechanical or civil engineer of to-day who knows nothing about electrical engineering, is not fully educated as an engineer. But this problem is even more vital than at first sight is obvious. It is the engineer of to-morrow, the engineer upon whom will devolve the work of the future, that this affects. We are in danger, during our lives as engineers, of living in watertight compartments. That is the fault of an age of specialisation—and of our own limitations. In this matter of specialisation in our work, we do but injure ourselves. In the matter of education, we incur a far graver responsibility. We affect the mental horizon for life of the youths in the London Colleges; we handicap them in an age when the rewards go only to the well-trained; we affect the student in a manner so detrimental that he shirks the study of electrical engineering.

At the present moment, throughout the country generally, engineering students do not take kindly to electrical work. There is an impression, which is probably fairly well grounded, that the electrical branch of engineering is overcrowded, and that it is easier—less difficult would be more accurate—to obtain a living salary in civil or mechanical engineering. This does not at all affect the point under debate. Every engineer should understand the mechanism of the steam engine; every engineer should know what is meant by the term "one Board of Trade unit." Discussion on this vital subject must not be stifled; let us have the reasons for and against plainly stated. The opponents should put forward tangible reasons for excluding electrical technology from the syllabus for any University degree in engineering.

Prof. Fleming deals at length with the matter of mathematics as a separate subject for engineers. There is a very great deal to be said upon this subject, but the temptation to enter fully into it must at present be resisted. At the same time it is surely reasonable that engineers, as a body, should know better than mathematicians what is actually required for the proper training of an engineer. Life is too short for intellectual gymnastics, when the same end can be attained by studying engineering problems. It is not sufficiently recognised that a proportion of less than one engineering student in fifty does research work in after life. The syllabus must be devised for the ordinary and not the extraordinary youth at college.

There is one other reform badly needed in connection with the Engineering Faculty of the University of London. It is now possible for a man to obtain a degree without doing any experimental engineering. That simply means that the degree can be obtained by a memory test. It is fatal to the status of the degree and to the education of the engineering student. There seems no valid reason why the so-called "external" degree in engineering should not be abolished. There are now ample facilities for students to attend evening

classes in engineering in the metropolis. London University has been called "the poor man's university," because it is quite easy for the Board School boy to graduate therein; it is not, however, sufficiently recognised that a degree in engineering requires a different type of instruction to that given to the student of classics. The importance of laboratory instruction must be emphasised; for a sound knowledge of the foundations of engineering work, that laboratory work should include tests on materials, heat engines, and electrical machinery.

There are other urgent matters connected with engineering and the London University which demand attention. For the moment we will concentrate upon the question raised by Prof. Fleming. The matter may be crystallised as follows: "Should not every engineering graduate be taught the elements of electrical technology?"

ELECTRICAL DEVELOPMENT IN 1908.

By R. BORLASE MATTHEWS, Wh. Ex., A.M.I.C.E.

During the past year great strides have been made in efforts to increase the demand for electrical energy by means of the education of the general public as to the latent possibilities of those varied applications of electricity which add to the convenience and comfort of everyday life, and also alleviate domestic and other labour.

In central station electricity supply work, the managements of a number of stations have realised the necessity for the reorganisation of their general system for obtaining new customers, for increasing the demand of existing consumers, and for ensuring that the service provided for the latter is such as to make them fully satisfied and, therefore, becoming in themselves good canvassers for persuading non-users to become consumers, as well as adding to their own consumption.

Perhaps what has done more than anything else to bring about these efforts to reorganise the commercial side of central station work has been the introduction of the metallic-filament lamp, the makers of which have naturally directed their attention to the easiest market, that is, among existing electricity consumers—especially shop-keepers. The falling off in the demand for units caused by the use of these new lamps has been a serious amount, which is not counteracted by the normal increase in new consumers. As the distribution and sale of these lamps has been entirely in the makers' and the contractors' hands, the proposition has always been put before the consumer in the shape of "your electricity bill halved" rather than "double the light for the same money," the latter being, of course, the policy that suits the central station manager best, and at the same time one that is advantageous to the consumer. Of course the metallic-filament lamp is a great boon to the central station manager, as it enables him to obtain many new consumers who otherwise could not be persuaded to come on to the mains, but, unfortunately, except in a few special cases, he has not been in a position to take full advantage of the lower cost of lighting now rendered available, in gaining fresh customers.

As an indication of the progress in the work of educating prospective consumers, it is interesting to note that over 165 central stations are now systematically distributing advertising matter of an educational nature. This, of course, is but one phase of the operation of a central station commercial department, though a feature that appears to an outsider as tangible proof of the energy of the central station, and this not without reason, for it will generally be found that the undertaking which has adopted a systematic advertising campaign, has often backed it up with a good general organisation. This backing up is not an easy matter, however, if the best possible results are to be attained, and many a station in copying the example of others in distributing advertising matter, neglects to follow it up with proper canvassing, without which advertising is of very little use. On the other hand, canvassing is not nearly so effective as when the way for the canvasser is prepared by suitable and attractive literature. The two methods must be employed in conjunction.

In sending out advertising matter many stations still overlook the value of regularity and persistency of distribution, features which are now recognised as being of utmost importance in the art of advertising. Further, the number of stations that have anything like an adequate and reliable list of prospective consumers is, unfortunately, but small; this in itself is a deterrent in obtaining the best results.

As regards canvassing, it is still difficult to obtain suitable men, though not so much so as it was two years ago, the interim having sufficed to get a number of canvassers partially trained, though not always along the best lines.

Altogether, when it is borne in mind what a period of depression has passed over the country, those managers who have adopted modern methods of new business-getting have to congratulate themselves on the results they have obtained, for they are in a much better position than are those central stations which have made no special efforts in this direction. There is no doubt that the stage of the policy of *laissez faire* and the practice of waiting for "natural growth" has now passed in the history of central electricity supply station management. The principles of the methods that have been proved successful in application to ordinary retail businesses, have now been thoroughly proved to be equally applicable to the retailing of electrical energy. Municipally-operated stations are now beginning to appreciate better than they did a few years ago that they are trading concerns, and, therefore, it is incumbent upon them to adopt trading methods if they are to be a success.

As regards the general electrical industry, steps have been quietly taken during the past year to obtain more co-operation among those interested in this great industry, with a view of sinking petty jealousies to enable united efforts to be made to achieve results that will benefit all. With this end, a Provisional Committee has met together to make the preliminary arrangements for the formation of an Electrical League, an organisation which it is expected will be able to unite the various sections of the industry under one general organisation, without destroying the individuality of each, or interfering with the work they are doing now, or that comes within their scope. It is hoped that early in 1909,* a pamphlet will be available which has been prepared by the Provisional Committee to give an indication of what it is considered should be the objects of the Electrical League, and the preliminary information necessary before the calling of a public meeting at which a president and council will be elected to carry on the work, the initial stages of which have been worked into shape by the Provisional Committee.

The Electrical League has been facetiously described as a "debating society," by those who are not properly acquainted with its aims and objects. To those who have had to do with the inaugural work, it is, however, a very much more serious matter than this, for it undoubtedly seems as if a great deal of good can be done in materially improving the position of the electrical industry, which, as all connected with it at present must admit, is in a very bad way.

SOME REMARKS ON FLATTING AND BLACKENING OF COMMUTATOR BARS.

[COMMUNICATED.]

The commutation problem is always a prominent one. *Pace* commutating poles and patent com. lubricants, the ways of commutators are at times uncertain, coy, and occasionally past finding out. Keen competition has made it imperative that the absolutely minimum quantity of raw material be put into a machine of given output. As a result of this cutting of material, flatting and blackening have become regrettably frequent.

It would, of course, be a fatal policy commercially for British designers to return to the very ample quantity of material per KW. of output, which was usual 8 or 10 years ago, but it is, perhaps, desirable to sound a note of caution regarding the present-day tendency unduly to increase the armature winding relatively to the field strength. There is

[*As will be seen by a reference to our leading article this week, the pamphlet mentioned has now been issued.—Eds.]

also a marked tendency largely to increase the peripheral speed of commutators.

Both of these factors tend to render reliable commutation less certain. Blackening does not always result in flatting. A commutator may assume a black and somewhat raw appearance, while maintaining good commutation. In such a case the discoloration is fairly regular all round the surface, but except that turning is rendered necessary more frequently than where a commutator runs with a glassy surface, the trouble is not a serious one. It must be noted that the life of the commutator is, of course, shortened.

The blackening mentioned above, is distinct from the discoloration observed on direct-current machines driven from gas engines, when the gas fumes darken the surface, without, however, destroying the skin.

While speaking of gas-driven plant, it would be of interest to have comparative costs of generator repairs for gas and steam-power house plants operating under similar load conditions. It is highly probable that the gas fumes and more unequal turning moment of the gas engine tend to deteriorate the insulation, and thus swell the repairs bill.

We will now consider the irregular blackening and consequent flatting which, if not rectified, will, in a short time, render the machine unfit for service. This effect may show up very soon after a new machine is put into operation. Or again, it may take some weeks or months to develop.

It is usually first noticeable on a few bars at irregular distances round the commutator. The breadth of each flat may not at first exceed one bar. The commutator may then be turned up and the machine again put to work, when flatting will once more appear, perhaps on the same bars, but more probably on other bars altogether. It is then only a question of time before the flats spread so far that grinding is again necessary. Inaccurate pitching of brush holders and pole-pieces, or faulty sweating of the armature conductors at the joints where they connect to the commutator lugs, will give rise to serious flatting.

Some modern machines are unduly sensitive to the first two causes. A close approximation to mathematical accuracy of pitching is absolutely imperative if good commutation is to be obtained.

Such a requirement undoubtedly increases, to an undue extent, the care and attention necessary to keep the machine in running condition, a slight contraction of the insulation between brush arms and rocker is sufficient to upset the whole brush setting.

When this, what may be called "abnormal" accuracy of setting, is essential to good commutation, it makes the re-assembly of a machine, which may have been dismantled, an uncertain business.

Should the pole-pieces or brush arms be ever so slightly out of position, and even with well-fitting bolts, this will occur, readjustment may extend over precious hours or days.

Unsuitable mica is a further fruitful source of flatting; the mica may be too thick or too hard, and in either case the result is the same. The mica projects, sooner or later, above the copper segments, it may be only by a very slight amount—so small as to be hardly detected by the finger nail when drawn over the surfaces. Bad contact between brushes and commutator bars follows and flatting is thus set up.

Hardness of the mica may be due to two causes; first, the mica may be of a nature unsuitable for commutator construction, and it is to be noted that suitable mica, due to the large demand, is increasingly difficult to obtain. Secondly, during construction a good commutator must be subjected to very great compression, in order that it may retain its shape under running conditions.

These conditions are severe, as not only has the centrifugal action to be allowed for, but the alternating stresses set up with expansion and contraction render it essential that the commutator be built up as nearly solid as its unmechanical nature will permit of. The compression thus necessary during construction renders the mica extremely hard, and as a consequence it does not wear equally with the copper of the commutator.

Treating the commutator with glass paper from time to time will sometimes serve to keep the mica down to the same level as the copper.

Better results will, however, be obtained by reducing the mica so that its top surface is from $\frac{1}{32}$ in. to $\frac{1}{16}$ in. below the surface of the copper. This can best be done with a fine saw, whose teeth can from time to time, as they lose the cutting edge, be re-sharpened.

At first sight one looks askance at this apparently drastic remedy Those of us who are imaginative may well conjure up pictures of alarming shorts as a consequence of copper and carbon dust lodging in the slots.

Experience proves that no trouble whatever on this score need be feared. It is, however, advisable that the slot be brushed out with a brush having short, stiff bristles—an ordinary nail brush is suitable—say once per week.

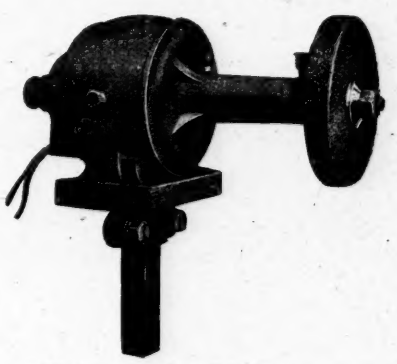
It will be found that, for a short while after the mica has been cut down, the brushes are noisy during running. This, however, will soon disappear.

In conclusion, it is not too much to say that many machines which previously seemed to call loudly for the scrap heap, have, by simply having the mica reduced as described, risen high in the estimation of their operators.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A New Kramos Electric Grinder.

In the accompanying illustration we show a new electric grinder recently constructed by Messrs. Kramos, Ltd., of Bath. It is a very powerful machine, rated to give 1 h.p. on continuous working. It is provided with a bar for fixing in the slide rest of a lathe, and the end bearing and shaft are prolonged 8 in., so that the machine can be used for internal work or grinding at angles when desired. If required for fixing to a lathe saddle, the machine can be fitted with base plate to suit, the tool post being omitted. The motor is shunt wound, and runs at a speed of 3,000 r.p.m., carrying an 8 in. × 1 in. grinding wheel. Double ball-thrust washers are provided, and the whole machine is completely enclosed. The motor is provided with 15 ft. of flexible cable and an adaptor, so that it can be operated from any ordinary lampholder.



The "Kramos" Electric Grinder.

In addition to the machine shown, Messrs. Kramos construct various other types of electric grinders, and also a selection of portable electric drills.

Improvement in No-Voltage Releases.

Most starting switches are provided with what is called a no-voltage release coil. This is, in fact, a requirement both of the Home Office, supply authorities, and insurance companies. The object of the device is to release the starting-switch lever in the event of a failure of supply, so that the motor cannot be started up again without resistance in circuit. The usual practice is to connect this coil in the shunt field circuit of the motor, so that the starting switch will be released and break the circuit in the event either of a failure of supply or of a break or disconnection in the shunt coil. This method has the advantage of dispensing with any additional resistances, such as are necessary when the no-volt release coil is connected across the supply lines. To release the switch one or more pushes are provided, connected up to the two ends of the no-volt release coil, so that on pressing the push the coil is short-circuited and demagnetised. This method of releasing the switch has the disadvantage that if the connecting wires to the short-circuiting push are of appreciable resistance as compared with the resistance of the coil, or if the contacts of the push are dirty so as to introduce resistance into the circuit, the switch is rendered uncertain in action, and at a critical moment may not

release when the push is pressed. A typical case is that of a printing machine which it is desired to stop from several points. The leads to the short-circuiting push are sometimes of considerable length, and many cases have arisen in which the switches have failed to release when the pushes have been pressed by the operator.

Owing to this uncertainty of action, the short-circuiting method is prohibited on some installations, and we believe the Admiralty do not accept it. The difficulty is sometimes overcome by the use of a special two-way switch, which breaks the coil circuit and introduces a buffer resistance into the shunt circuit of the motor. Another method is to connect the no-volt release coil across the line in series with a resistance, using a breaking push instead of a short-circuiting push.

Both these methods have disadvantages, the former necessitating a special two-way push and expensive resistance, and the latter has the disadvantage of introducing the full voltage of supply into the push. Cases have occurred of such pushes arcing over the contacts

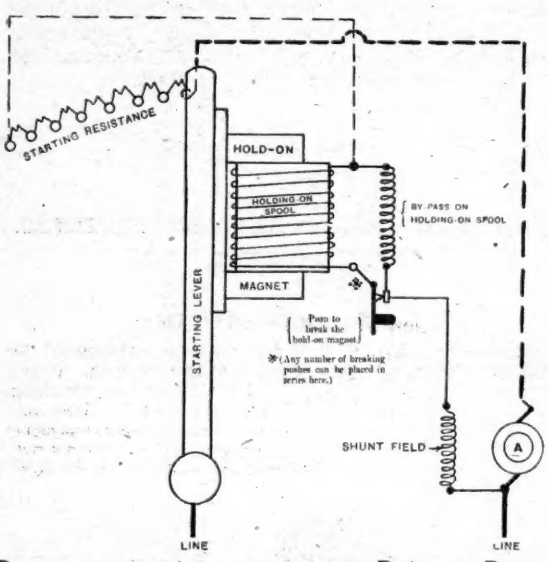


Diagram showing Arrangement of the Broadbent Release for Starting Switches.

or to the metal case of the push, either burning out the contacts or giving shocks to the operator when used on circuits of over, say, 200 volts. Considering that voltages up to 480 volts are now quite common, it is obvious that a push, satisfactorily to break this voltage safely, must be of a very robust and substantial character.

A simple method has been devised by Mr. Frank Broadbent, who has devoted special attention to the details of motor-starting switchgear. In his patented device the holding-on coil is provided with a small by-pass resistance which may be of quite an inexpensive character, consisting, say, of a lamp or a small resistance bearing some relation to that of the holding-on spool. Ordinarily—that is, when the motor is running—the holding-on spool and its by-pass resistance are in parallel. To release the switch a push is pressed which merely breaks the circuit of the holding-on spool, leaving the by-pass intact, so that the shunt can discharge through the armature in the ordinary way without the use of any buffer resistances. The diagram above makes the action quite clear. It will be readily understood from the diagram, that when the push is pressed, it breaks only the small current carried by the spool, at a voltage which is only a small fraction of the voltage of supply. Thus, on a 500-volt circuit, the pressure across the spool would probably not be above 25 volts, and the current, probably ·25 ampere. Any number of pushes may be placed in series and the circuit broken with certainty, quite irrespective of the resistance of the connecting leads. We understand that Mr. Broadbent's device has been well received by many important starting-switch makers, who have expressed their intention of taking up licences for its use.

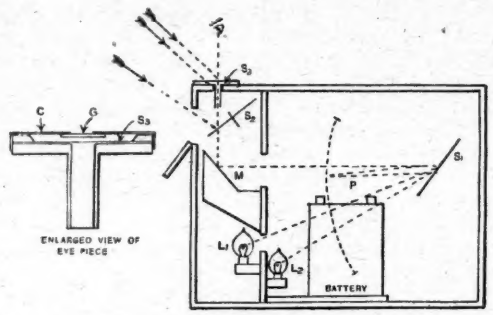
Harrison Universal Photometer (Improved).

This instrument, which is manufactured by Messrs. Elliott Bros., has recently been considerably improved by the addition of a simple attachment that enables the horizontal illumination from all sources to be measured. The instrument is intended for the measurement of illumination on a screen making an angle of 45° with the vertical, and for the measurement of the candle-power of various sources of light; it is provided with a flicker disk, rotated by a blast of air under the control of the operator. By fixing the flicker disk to cover half the field of view of the eye-piece, the instrument may be used as a direct comparison photometer, the illumination of the source of light being compared directly with that of the adjustable screen inside the instrument, which is illuminated by a small standard lamp connected to a self-contained accumulator battery.

The recent addition to the instrument consists of a horizontal screen, which is covered by a cap when the flicker disk is used. This cap has a hole through the centre, and forms the eye-piece of the instrument. When the cap is removed the horizontal screen is exposed, and by fixing the flicker disk out of the field of view of the eye-piece by means of a small milled-headed screw, the photometer can be used to measure horizontal illumination by direct comparison.

The sectional view of the instrument, together with the enlarged view of the eye-piece, given below, will make the construction quite clear.

The illumination to be measured is in all cases read off directly on the scale by means of the pointer shown, which is fixed to the adjustable screen mentioned above; by moving the screen, balance



S_1, Adjustable screen attached to —P,s Pointer ton outside of case; S_2, Revolving sector screen for general illumination; S_3, Screen for horizontal illumination; M, Reflecting mirror; L_1, L_2, Standard lamps; C, Cover cap, to be removed when taking horizontal illumination; G, Glass in eye-piece.

The Harrison Improved Photometer.

is obtained between the illumination of the source of light under test and that due to one of the small standard lamps inside the instrument.

The original features of the instrument have all been retained, and the new model is just as simple to manipulate as the older pattern. The advantages claimed for it include light weight and portability; long range, due to the use of two standard lamps of different candle-powers; permanent connection between the battery and the rest of the circuit, which need never be disconnected for charging purposes, &c.; and facility for removing the battery, standard lamps and flicker disk for inspection, without disconnecting or altering any adjustments.

The addition of the horizontal attachment does not increase the cost of the instrument, owing to its simple construction and method of manufacture.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

BRAZIL.—In the case of shipments to this country, consular invoices in English or Portuguese must be made out on special forms, showing the gross weight of packages, gross weight of merchandise with coverings such as drums, bags, cases, cardboard boxes, &c., and the net weight of the merchandise, exclusive of all packing and covers. In cases where duty is calculated otherwise than by weight, the quantity (dozen, thousand, &c.) must be declared. Three copies of the consular invoice must be made out; the first will be returned to the shipper to forward to the consignee, in order to obtain delivery of the merchandise by the Custom House, the second will be forwarded to the Department of Commercial Statistics by the consul, and the third will be kept by the consul for his own use. Forms may be obtained from Messrs. Wm. Brown & Co., Ltd., 40-41, Old Broad Street, E.C., and 36-42, St. Mary Axe, E.C. A fee of 6s. 9d. is charged for consular visa. It is imperative that the material from which each separate article is made shall be declared. Invoices for goods for which ad valorem duties are payable must contain information as to the expenses, such as shipping charges, freight, insurance, commission, &c., as well as the value of the goods. The port of shipment of the goods must be declared on all documents, and this port must be that from which the goods are actually shipped to Brazil. Consular invoices will not be required for parcels or samples of a value, in the place of importation, not exceeding £10 or its equivalent, inclusive of freight, packing, commission, &c.

35 per cent. of the sum payable as duty in any specific case is calculated in gold milreis (gold milreis = 2s. 3d.), the remainder of the duty is calculated in currency (currency, milreis = 1s. 3d.).

A surtax of 2 per cent. gold is charged on all goods imported into Brazil through the ports of Rio de Janeiro, Rio Grande do Sul, Para, Pernambuco and Bahia.

	Reis per kg.
Pulleys, tackle and blocks, and similar block-makers' wares	500
Paper, in bands or ribbons, for telegraphs	300

	Reis per kg.
Lamp-shades and the like, of paper	2,000
Vessels for batteries, insulators, buttons for electric bells and articles of faience or earthenware of all kinds, with or without copper, for electric installations	200
NOTE.—Iron brackets or supports imported with insulators and not attached thereto, and screws of iron or wood, are dutiable separately.	
Glass insulators for telegraph or telephone posts ...	100
Conduits or pipes of clay	100
Shades, globes, lamp chimneys, glass reflectors, &c.:	
Of glass, plain or moulded, and emery-ground or dulled glass	1,100
Of glass, cut or wrought wholly or in part ...	2,000
Vessels for batteries, of glass	400
Electric bells, of copper, with cases of wood, iron or any other material, for whatever use ...	4,000
Copper wire:—	
Not covered, of white, red or yellow metal ...	400
Covered with paper, cotton, rubber or any other material, for whatever use	900
Gilt or silvered, or covered with silk pure, or mixed with cotton, wool or linen, for whatever use	2,400
Covered with cotton and rubber, with an envelope of lead or iron, for submarine or underground cables, telegraphs, telephones, electric power and light, and all other electric installations	20% ad val.

	Reis per kg.
Articles not specially mentioned, of copper, filed or simply polished, varnished, tinned or bronzed, or with ornaments of any other common metal	2,000
NOTE.—Articles with accessories of faience, porcelain or glass are included in this heading. Shades and globes belonging to the said articles, and dutiable separately, are excepted.	
Lead in tubes for water and gas	200
Iron wire:—	
Of any quality and thickness, plain or galvanised	100
Covered with paper, silk, or cotton	1,200
Rails:—	
Weighing per lineal metre, up to 10 kg.	50
Ditto, more than 10 kg.	15
Spikes or bolts, chairs and screws adapted to rails, and imported with the rails, are dutiable as such.	
Ditto, imported separately	80
Iron pipes, plain or galvanised, for boilers, water, gas and similar uses, straight or curved, covered or not	100
Pieces of iron for the construction of buildings, fences, &c., posts for telegraphs, telephones and the like, fitted or not	20% ad val.
Wagons, carriages, &c., for railways, and accessories for same	30% ad val.
Electric, hydrogena-platinic, pneumatic and other machines	15% ad val.
Mathematical, physical, chemical or optical instruments and apparatus not specially mentioned in the tariff	15% ad val.
Pumps, common:—Of cast-iron, 400; of iron and brass, 600; of brass or bronze, 1,000 reis per kg.	
Suction and force pumps:—Of cast-iron, 600; of iron and brass, 800; of brass or bronze, 1,300 reis per kg.	
Steam pumps	15% ad val.
Machine belting, of cotton or rubber ...	1,800 reis per kg.
NOTE.—Belts imported with machines are liable to the duties leviable thereon.	
Lifting and transmission apparatus; steam, electric and hydraulic cranes for warehouses; other cranes of all kinds	15% ad val.
Differential pullies and blocks, Weston's and the like	200 reis per kg.
Dynamos and other electric apparatus for the distribution of power and light; locomotives and tenders; traction engines; hydraulic motors (turbines and hydraulic wheels); windmills; other motors of all kinds	15% ad val.
Lightning rods, complete with several branches, plain or with a platinum point	15,000 reis each
Lightning rods, single branch, plain or with a platinum point	6,000 reis each
NOTE.—Complete lightning rods do not include the conducting cables.	

	Reis per kg.
Transmission belts of rubber, celluloid and gutta-percha	1,000
Manufactures of rubber, combined with tissues of cotton, wool or linen:—	
On the piece or in cuttings	4,000
On articles not specially mentioned in the Tariff	7,000
Manufactures of rubber, combined with tissues of pure or mixed silk:—	
On the piece or in cuttings	7,000
On articles not specially mentioned in the Tariff	15,000
Manufactures of rubber not specially mentioned in the Tariff	50% ad val.

NOTE.—Exemption from Customs duties may be granted in favour of electric companies using hydraulic power, when the work undertaken by them is for purposes of public utility. An application requesting exemption from Customs duties under this provision should be made for every consignment of the material deemed necessary by the Government for carrying out the work in hand.

NEW PATENTS APPLIED FOR, 1908.

Compiled expressly for this journal by W. P. THOMPSON & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,694. "Improvements in brakes for tramcars and other electrically-operated vehicles." A. A. BLACKBURN. December 21st.

27,729. "Improvements in ceiling roses and the like for use in electric circuits." F. G. BAZELL and R. B. VERNEY. December 21st.

27,743. "Improvements in machines for armouring cables with flexible metal tubing." E. WITZENMANN. December 21st.

27,746. "Improvements in wireless telegraphy." A. F. H. S. SIMPSON. December 21st.

27,748. "Electric railway conduit and electric equipment therefor." W. FAIRWEATHER. (E. E. Granger, United States.) December 21st.

27,763. "Improvements in or relating to bodies for incandescent lighting." M. M. KOKOTECK and I. KNASTER and W. F. OFFORD. December 21st.

27,784. "Improvements in and relating to electric advertising devices." W. K. L. DICKSON. December 21st.

27,796. "Improvements in the therapeutic use of electricity especially under water." W. RUBINER. December 21st.

27,810. "Electrically heated bed, incubator, germinator or Turkish bath." J. A. ABBOTT. December 22nd.

27,816. "Improvements in and in the production of tilting shade holders or carriers for electric lamps." M. LAWTON and H. WHATSON. December 22nd.

27,832. "Improvement in or connected with trolley arms of electric tramcars." T. HOLDSWORTH. December 22nd.

27,833. "Slow-speed operating gear for electric motor-starters and the like." VERITYS, LTD., and W. G. PIPKIN. December 22nd.

27,834. "Operating handle mechanism for slow-speed gear of electric motor-starters or the like." VERITYS, LTD., and W. G. PIPKIN. December 22nd.

27,836. "Improvements in and relating to vapour electric lamps." W. J. H. WOOD and F. C. B. WOOD. December 22nd.

27,858 and 27,859. "Improvements in the distribution of electric energy." A. E. TANNER and E. A. CLAREMONT. December 22nd.

27,860. "Improvements in and relating to electric incandescent metal-filament lamps." J. J. B. CROSS and MERCHANTS TRADING CO., LTD. December 22nd.

27,862. "Improvements in and relating to telegraphic recording apparatus." T. MC C. DE BINGHAM. December 22nd.

27,867. "Improvements in electric telegraphy." A. MUIRHEAD. December 22nd.

27,882. "Improvements in storage batteries." C. H. MONTGOMERY, J. J. YOUNG, R. E. HELLYER and R. J. E. BAKER trading as The Southsea Motor Engineering Co. December 22nd. (Complete.)

27,899. "Improvements in or connected with arc lamp electrodes." F. M. LEWIS. December 22nd.

27,906. "Improvements in or relating to electric railway switch mechanism." P. M. JUSTICE. (The American Automatic Switch Co., United States.) December 22nd. (Complete.)

27,923. "Improvements in locomotive electric alarm systems." A. VUMMINGS and G. NOREAU. December 23rd. (Complete.)

27,932. "Improvements in coin-controlled and coin indicating mechanism for use chiefly with telephones and the like." W. J. F. WASHINGTON, H. WASHINGTON and H. C. D. SCOTT. December 23rd.

27,951. "Cable telegraphy." L. VON KORPEN. December 23rd. (Complete.)

27,953. "Door switch." R. JACKSON and C. A. GAFFNEY. December 23rd.

27,965. "Improvements in electric heaters." F. W. F. ROSS. December 23rd.

27,967. "Improved means for governing the speed of alternating-current commutating machines." H. C. E. JACOBY. (Application for Patent of Addition to No. 20,495 of 1907.) December 23rd.

27,986. "Improvements in transmission and like gear of the magnetic type." W. B. MAIR. December 23rd.

27,991. "Improvements in lamp supports and casings particularly designed for use with electric incandescent lamps." J. S. HIGHFIELD. December 23rd.

27,999. "Improved magneto-electric sparking apparatus." W. P. THOMPSON. (E. Eisemann & Co., G.m.b.H., Germany.) December 23rd. (Complete.)

28,014. "Trolley-car switch controller." S. USLIANER. December 23rd.

28,017. "Improvements in systems of electric motor control." H. C. SOULE. (Date applied for under Sec. 91 of the Act, January 10th, 1908, being date of application in United States.) December 23rd. (Complete.)

28,019. "Improvements in and relating to electrical machinery." S. Z. DE FERRANTI. December 23rd.

28,040. "Improvements in and relating to dynamo-electric machines." T. FERGUSON. December 24th.

28,050. "Improvement in or applicable to trolley heads for electrical overhead traction." T. M. PHILLIPS. December 24th.

28,075. "Supporting arrangement for plates and electrodes for batteries and accumulators." A. BILARD. December 24th.

28,076. "Contact device on a travelling bridge crane to convey current from an electric overhead conductor to an electric locomotive passing under the same without interfering with the working of the crane." C. K. MILLS. (Maschinen und Dampfkesselfabrik "Guilleaume Werke," G.m.b.H., Germany.) December 24th.

28,092. "Improved construction of regulating electric switch." VERITYS, LTD., and W. G. PIPKIN. December 24th.

28,102. "Improved coupling for electric cables, wires and rods." F. WESTCOTT and F. GARTSIDE. December 24th. (Complete.)

28,118. "Improvements in fitting watch or clock chronograph hands and their connections for electrically ringing bells and the like." W. JARDWICK and H. WILLIAMSON, LTD. December 24th.

28,120. "Improvements in appliances for the electric lighting and heating of vehicles." H. GROS. (Date applied for under Sec. 91 of the Act, January 2nd, 1908, being date of application in Germany.) December 24th. (Complete.)

28,130. "Improvements in electrical induction clutches." A. P. STECKEL. December 24th. (Complete.)

28,135. "Improvements in electrical advertising devices." W. K.-L. DICKSON. December 24th.

28,147. "Improvements in electrolytic cells." A. E. GIBBS. (Date applied for under Rule 18, December 17th, 1907, an invention comprised in application No. 27,830, dated December 17th, 1907.) December 24th. (Complete.)

28,156. "Improvements in dynamo-electric machines." S. C. Davidson. December 24th.

28,177. "Improvements in or relating to holders or sockets for incandescent electric lamps." H. W. Marsh. December 24th.

28,186. "Improvements in or relating to electric alternating-current distributing systems." C. H. Merz and B. Price. December 24th.

28,188. "Improvements in and relating to controllers for electric motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.)

28,189. "Improvements in and relating to single-phase alternating-current electric motors of the commutator type." E. F. W. Alexanderson. (Date applied for under Sec. 91 of the Act, December 26th, 1907, being date of application in United States.) December 24th. (Complete.)

28,190. "Improvements in electric voltage regulators." A. A. Tirrill. (Date applied for under Sec. 91 of the Act, April 27th, 1908, being date of application in United States.) December 24th. (Complete.)

28,192. "Improvements in or relating to starting devices for electric motors." Allgemeine Elektricitats-Ges. (Date applied for under Sec. 91 of the Act, December 28th, 1907, being date of application in Germany.) December 28th. (Complete.)

28,193. "Electrical-driven toy by animal electricity." J. T. B. King (trading as Brassington & Cooke). December 28th.

28,216. "Magnetic lock for locking railway carriage doors, safes, and the like." G. P. Fairless and W. T. Dixon. December 28th.

28,226. "Improvements in certain kinds of regulating electric switches." Veritys, Ltd., and W. G. Pipkin. December 28th. (Complete.)

28,267. "Improvements relating to telephone receivers." T. F. Conti. December 28th.

28,271. "Improvements in single-phase alternating electric-current meters." H. Aron Elektricitats Zahlerfabrik G.m.b.H. (Date applied for under Sec. 91 of the Act, October 9th, 1908, being date of application in Germany.) December 28th. (Complete.)

28,276. "Improvements in or relating to electric furnaces." A. Voelker. December 28th. (Complete.)

28,285. "Improvements in or relating to electric batteries." A. J. Boult (T. McNaughton, United States.) December 28th. (Complete.)

28,286. "Improvements in or relating to electric self-winding clocks." A. J. Boult. (H. O. Jackson and T. McNaughton, United States.) December 28th. (Complete.)

28,287. "Improvements in or relating to electric secondary clocks." A. J. Boult. (H. O. Jackson and T. McNaughton, United States.) December 28th. (Complete.)

28,290. "Improvements in or relating to galvanic batteries." S. Benko. December 28th. (Complete.)

28,294. "Improvements in or in connection with electric lamps, adapters and other analogous purposes." F. Wilkins. December 28th.

28,300. Improvements in pole-pieces or pole-shoes for electric machines with compensation windings." H. Grob. (Date applied for under Sec. 91 of the Act, January 2nd, 1908, being date of application in Germany.) December 28th. (Complete.)

28,319. "New dynamo-electric machine for continuous currents." E. W. Bohle. (H. Bohle, Cape Colony.) December 29th.

28,324. "Improvements in dynamo-electric machines." Electromotors, Ltd., and E. Greenhalgh. December 29th.

28,351. "Improvements in controllers for electric motors." R. F. Baerlocher. December 29th.

28,366. Same as 28,367, but not complete.

28,367. "Improvements in contrivances for detecting and recording the passage of electric impulses." A. Orling. December 29th. (Complete.)

28,378. "Improvements in and relating to wireless telegraphy and the like." S. Eisenstein. December 29th.

28,397. "Improvements in or relating to boxes for junctions, testing, inspecting or fuse purposes and the like, for use in connection with electrical cables and the like." H. R. Mansfield. December 30th.

28,435. "Improvements in incandescent gas and electric filaments." R. Laigle. (Date applied for under Sec. 91 of the Act, January 10th, 1908, being date of application in Switzerland.) December 30th. (Complete.)

28,438. "Process of and apparatus for obtaining variation and reduction of speed electro-dynamically." M. Johannet. (Date applied for under Sec. 91 of the Act, February 3rd, 1908, being date of application in France.) December 30th. (Complete.)

28,442. "Improvements in the insulation of the layers of windings of electromagnetic apparatus." The firm R. Bosch. (Date applied for under Sec. 91 of the Act, December 12th, 1908, being date of application in Germany.) December 30th. (Complete.)

28,467. "Improvements in the method of supporting and adjusting overhead electric current wires." R. Brierley. December 31st.

28,474. "Improvements in connection with electric current or voltage regulators." W. J. Poole. December 31st. (Complete.)

28,481. "Improved connector for rubber hose pipe, flexible tubing, flexible electric wires and the like." A. J. Cann. December 31st.

28,485. "Improved aerial electric cable." C. J. Beaver and E. A. Claremont. December 31st. (Complete.)

28,487. "Brush-holder attachment or brush yoke for electric motors and dynamos." S. Miller and S. Adshead. December 31st.

22,506. "Improvements in electric lamp-holders for decorative lighting." H. Bey. December 31st.

28,522. "Improvements in voltmeters, ammeters, wattmeters and like electrical indicating and recording instruments." W. O. Smith and W. Phillips. December 31st.

28,525. "Electric transmission of visual images." L. Anspach. December 31st. (Complete.)

28,545. "Improvements relating to the insulation of electric conductors." Art-Ges. Brown, Boveri et Cie. (Date applied for under Sec. 91 of the Act, July 3rd, 1908, being date of application in Germany.) December 31st. (Complete.)

28,548. "Improvement in magneto-ignition apparatus." Firm of R. Bosch. (Date applied for under Sec. 91 of the Act, September 25th, 1908, being date of application in Germany.) December 31st. (Complete.)

28,554. "Process for manufacturing flat incandescent filaments for metallic-filament lamps." W. Schaffer. (Date applied for under Sec. 91 of the Act, January 2nd, 1908, being date of application in Germany.) December 31st. (Complete.)

28,561. "Improvements in or relating to electrolytic devices suitable for use as or in the construction of switches, recorders, meters and other apparatus." W. B. Thorpe. December 31st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool and Bradford price, post free, 9d. (in stamps).

1907.

Means of Supporting Filaments in Incandescent Electric Lamps. F. Harrison. 26,294. November 28th. (Post-dated June 27th, 1908.)

Electric Arc Lamps. W. J. Davy. 27,034. December 6th.

BOOK NOTICES.

Dynamo, Motor and Switchboard Circuits for Electrical Engineers. By W. R. Bowker. London: Crosby Lockwood & Co. Second edition. Price 7s. 6d. net. — This work is essentially a practical treatise, and in this second edition two new sections are added, dealing with central stations. There are 130 illustrations of such things as reversible series motors, four-pole compound dynamo with compensating poles, paralleling two-phase generators, three-phase motor and controller, &c. The illustrations appear to be excellently done, and many of these are complicated diagrams of tramways, controllers, &c., which will doubtless be of great use to engineers. The book will also be found of use to students preparing for such examinations as the City and Guilds of London Institute, where such questions as "Sketch and describe a three-phase lift controller," or "How can two compound dynamos be run in parallel?" have to be answered. We think the author has compiled a decidedly useful book, and heartily recommend it to those interested.

Electrical Laboratory Course for Junior Students. By R. D. Archibald, B.Sc., and R. Rankin, A.G.T.C. London: Blackie and Co. Price 1s. 6d. net.—As stated in the preface, this book is intended to cover an elementary first year's evening course, and part of a second year's course. The little work consists of 93 pages and some 57 experiments. The experiments are of the usual type on magnetism and electricity. As a rule most treatises on electrical testing begin with experiments on magnetism nowadays, but this one starts with frictional electricity. The experiments are, however, well chosen and interesting. The work may be safely recommended to students. Here and there the language is peculiar, "metre stick" being used for metre scale, and "the most of" for "most of," &c. Otherwise, it is quite an excellent little treatise; although perhaps "Resistance of a galvanometer," by Thomson's method, is rather beyond the students for whom it is written. It is excellently printed and illustrated.

The Science Year-Book for 1909. Price 5s. net.—Not the least welcome of the New Year annuals is the "Science Year-Book," edited by Major B. F. S. Baden-Powell, and published by Messrs. King, Sell & Olding, Ltd., from the same office as our valued contemporary *Knowledge*. Besides the excellent diary, a page to each day, with useful data in the headings, there is, as usual, a large section dealing with general astronomical, physical, chemical and meteorological information, a sketch of science progress during the past year, a glossary of scientific terms, name directory and biographical directory. The ingenious desk almanac and diary of engagements is particularly neat. Regarding the journal, *Knowledge*, of which a special double number has come to hand for January, we note that its size has been increased to nearly double that formerly adopted, and that there are four large plates on art paper—one being a portrait of Prof. Sir J. J. Thomson, F.R.S., in his laboratory. We never fail to find matter of interest to us in *Knowledge*, or in its associate *Aeronautics*, the first volume of which, from the same office, has just been completed.

The Motorists' Diary and Year Book, 1909. London: Chas. Knight & Co. Price 2s. net.—This pocket-book provides, besides a diary, a variety of information likely to be of use to motor-car owners, as well as an important section on motor law, contributed by Mr. C. C. Macklin, one of the solicitors to the Automobile Association. There is also a touring section, giving particulars of routes in Great Britain and France, lists of garages, &c., and a collection of motor records and tables.

Willing's Press Guide, 1909. London: Jas. Willing, jun., Ltd., 125, Strand, W.C.—This handy directory has reached its thirty-sixth annual issue. It has again been revised and brought up to date, and is an excellent shillingsworth for the use of those who desire to know the addresses, days of publication, and other such information concerning all papers of consequence in this country, and some in the colonies and foreign parts.

"The Right to Work." By Harold Cox, M.P. This is a reprint of an article (with editions) which appeared in the *Quarterly Review* for January, and it is being sold at 1d. by Watts & Co., 17, Johnson's Court, Fleet Street, E.C., on behalf of the Liberty and Property Defence League. It is a reply to the Socialist "Right to Work" cry.

"Fire Tests with Fire Extinguishers." Buckets of water, &c., asbestos cloths, sand and steam. Red books of the British Fire Prevention Committee, Nos. 128 and 133. London: British Fire Prevention Committee, 1908. Price 2s. 6d. each number.

—"A Scheme for the Promotion of Scientific Research." By W. B. Priest. Second edition. London: Stevens & Sons, Ltd. 1908. Price 3s.

"The Trade and Industry of Australasia." By B. H. Morgan. London: Eyre & Spottiswoode, Ltd. 1909.

"Annual Report of the Commissioner of Patents, 1907." Washington: Government Printing Office. 1908.

"Bulletin of the Massachusetts Institute of Technology; Vol. 44, No. 1. Boston, U.S.A.: The Institute.

With its January issue our contemporary, *The Illuminating Engineer*, of which Mr. Leon Gaster is editor, commences its second volume. Among the articles in this issue is a fully illustrated one on the "Illumination of Churches," giving views of interiors of many churches in this and other countries.